USER MANUAL

FMUX-01A

Fiber Optical Multiplexer
Standalone / Rack Type
4, 8, 12 or 16 Channel Modular Design
G.703 E1, T1(DS1)
Datacom V.35, X.21, RS-530, RS-449, RS-232
Ethernet 10/100Base-TX Bridge
SNMP Manageable

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CTC Union Technologies Co., Ltd.
Far Eastern Vienna Technology Center (Neihu Technology Park)
8F, No. 60, Zhouzi St.
Neihu, Taipei, 114
Taiwan

Phone: +886-2-2659-1021
FAX: +886-2-2799-1355

FMUX-01A
Platform fiber multiplexer with 4, 8, 12, 16 channels E1, T1, Data communication, or 10/100Base-TX Ethernet Bridge.
Installation and Operation Manual
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This manual supports the following models:

FMUX-01A

This document is the third official release manual. Please check CTC Union's website for any updated manual or contact us by E-mail at info@ctcu.com. Please address any comments for improving this manual or to point out omissions or errors to marketing@ctcu.com. Thank you.

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Chapter 1. Introduction

1.1 General

Thank you for choosing the ***Platform Fiber Multiplexer***. If you would like to skip right to the installation and configuration of the Multiplexer, proceed to Chapters 3 and 4.

The ***Fiber Multiplexer*** is a 1U (1.75") high standalone or 19/23" rack mountable E1/T1/Data/LAN Bridge multiplexer over fiber link, built upon a highly flexible, modular design. The ***Fiber Multiplexer*** provides an economic optical connection solution in high-density E1 and/or T1 installations such as between branch offices, where multiple high speed synchronous data communications are required or to link a mix of platforms over a single fiber pair. By utilizing a modular design, a large variety of configurations may be realized and the unit may be easily custom tailored for each specific application when ordered. The 4-CHANNEL E1, T1, V.35 (X.21/RS-530/RS-449) data, Ethernet Bridge Port cards and optical interface cards are all optional. The standard unit is a chassis with local control and ordered with single or dual power. The appropriate hot swappable optical interface cards may be selected to support multi-mode or single-mode fiber cable operation, with a variety of transceiver power and connector options including ST™, SC, FC, LC, or MT-RJ. WDM (Wave Division Multiplexing) optical interfaces are also available to provide bi-directional transmission on a single fiber to reduce cost when using leased fiber links. The range of transmission for optical connection is from 2Km (for multi-mode) up to 120Km (single mode). **External Clock Card** (external or internal clock source) and **SNMP Card** (for local and remote management purposes) may be optionally installed in the chassis.

1.2 Functional Description

The ***Fiber Multiplexer*** basic chassis is available in five power supply configurations. Depending on the model, power may be derived from single AC 90~250VAC, single DC +20~60VDC, dual AC 90~250VAC, dual DC +20~60VDC, or AC plus DC power sources. The ***Fiber Multiplexer*** provides all Line Card connections on the rear panel. There are 4 slots available for installation of **4-CHANNEL E1** or **T1 Port Cards** (ITU-T G.703 E1/T1), **4-CHANNEL Data Port Cards** (RS-530, X.21, RS-449, V.35, or RS-232), or **Single-CHANNEL Ethernet Bridge LAN Port Cards** (10/100Base-TX) into the ***Fiber Multiplexer*** chassis. Each 4-CHANNEL Port Card provides 4 individual channels of E1, T1, or Datacom per Port Card. The **Single-CHANNEL Ethernet Bridge LAN Port Card** provides one 8.192Mb/s (4xE1 speed) WAN link for 10/100Base Ethernet LAN bridging applications.

The **4-CHANNEL E1 Port Card** has the option of using BNC (75 Ohm unbalanced) or RJ-45 (120 Ohm balanced) connectors for E1 Line interface connections and supports four separate E1 channels at a transmission rate of 2.048Mb/s (transparent unframed E1) each.

The **4-CHANNEL T1 Port Card** provides four RJ-45 (100 Ohm balanced) connectors for T1(DS1) Line interface connections and supports four separate T1 (DS1) channels at a transmission rate of 1.544Mb/s (transparent unframed T1) each.

The **4-CHANNEL Data Port Card** provides four standard nx56/nx64Kb/s, up to 2.048Mb/s for V.35 (or X.21, RS-530, RS-449, RS-232) DCE ports on MB34 (DB15, DB25, DB37, DB25) female or male connectors (required adapter cables optional) for direct connection to terminal equipment.

The **Ethernet Bridge Port Card** provides an RJ-45 connector for 10Base-T or 100Base-TX Ethernet (auto negotiation) connections. The bridging function provides LAN to LAN segment links which operate under the same network address space.

LEDs on the front panel will show both the channel statuses and any alarm indications for installed port cards (except Ethernet card which display link status on the card itself).

Chapter 1. Introduction

The ***Fiber Multiplexer*** **E1** and **T1 Interface Cards** fully meet all E1 and T1 specifications including ITU-T G.703, G.704, G.732, G.733, G.823 and G.824. The Bridge Interface Card meets all Ethernet specifications for IEEE802.3 and IEEE802.3u.

Each **4-CHANNEL Port Card** features diagnostic capabilities for performing local loop back or remote loop back (except for Ethernet Bridge card). The loop back function is controlled by the front panel LCD menu, terminal mode (RS-232 console) or when the SNMP option board is installed via Telnet or SNMP set commands.

Up to five clock source selections are provided. Without the external clock card option, the unit operates from an internal free running oscillator. When the external clock card option is installed, additional clock sources may be selected from the clock card's own internal oscillator or from an external clock references for E1 PCM, E1 TTL, T1 PCM, or T1 TTL. All E1 and T1 equipment may connect to the ***Fiber Multiplexer*** without regard to master or slave timing. The ***Fiber Multiplexer*** is completely transparent to clocking and data transmission. This makes configuration of the MUX extremely easy.

The Fiber Multiplexer provides optical interfaces (1+1) that are completely redundant and hot swappable. By utilizing a modular design, fiber type (single mode or multi mode), the optical power margin requirement and connector type can be easily chosen at installation time. This provides an extremely flexible main unit which is not tied to a fixed optical interface. When two optical modules are installed, the secondary module is in "standby", in case of any failure in the primary path. If the primary fiber path fails, the switchover time to the secondary fiber is less than 50 milliseconds (industry standard). The automatic fall over function of the fiber allows the fiber to continue to run in the secondary fiber, even after primary fiber connection is restored. This will avoid another 50 millisecond loss of transmission on all channels. The fiber path can also be forced from primary to secondary or back through the LCD menu or terminal console.

When the ***Fiber Multiplexer*** is ordered with an optional **SNMP Card**, the card is installed inside the chassis. Configuration is accomplished via local control on the asynchronous RS-232 port with a standard VT-100 terminal, via Ethernet and Telnet, or via any standard SNMP network management software over Ethernet. The ***Fiber Multiplexer*** also has a Windows™ based GUI management program that communicates with the ***Fiber Multiplexer*** via SNMP protocol to display all status in real time, configure the unit, provides performance monitoring, and display alarm buffers and real time trap messages. If the **SNMP Card** option is not installed, local and remote management is still possible via the unit's internal menu system accessible from the front panel LCD and menu keys, or via the asynchronous RS-232 port with a standard VT-100 terminal.

The ***Fiber Multiplexer*** also includes the ability to do in-band remote configuration. Once the fiber optic link has been established, the remote unit may be configured or status checked from the local unit using any of the available management options.

Chapter 1. Introduction

The following photo, with graphics, shows the major components which make up the ***Fiber Multiplexer*** (with the External Clock and SNMP options installed). This photo shows a unit with E1-BNC card in port 1, X.21 data communications card in port 2, T1-RJ45 card in port 3, and 10/100Base Ethernet bridge in port 4.

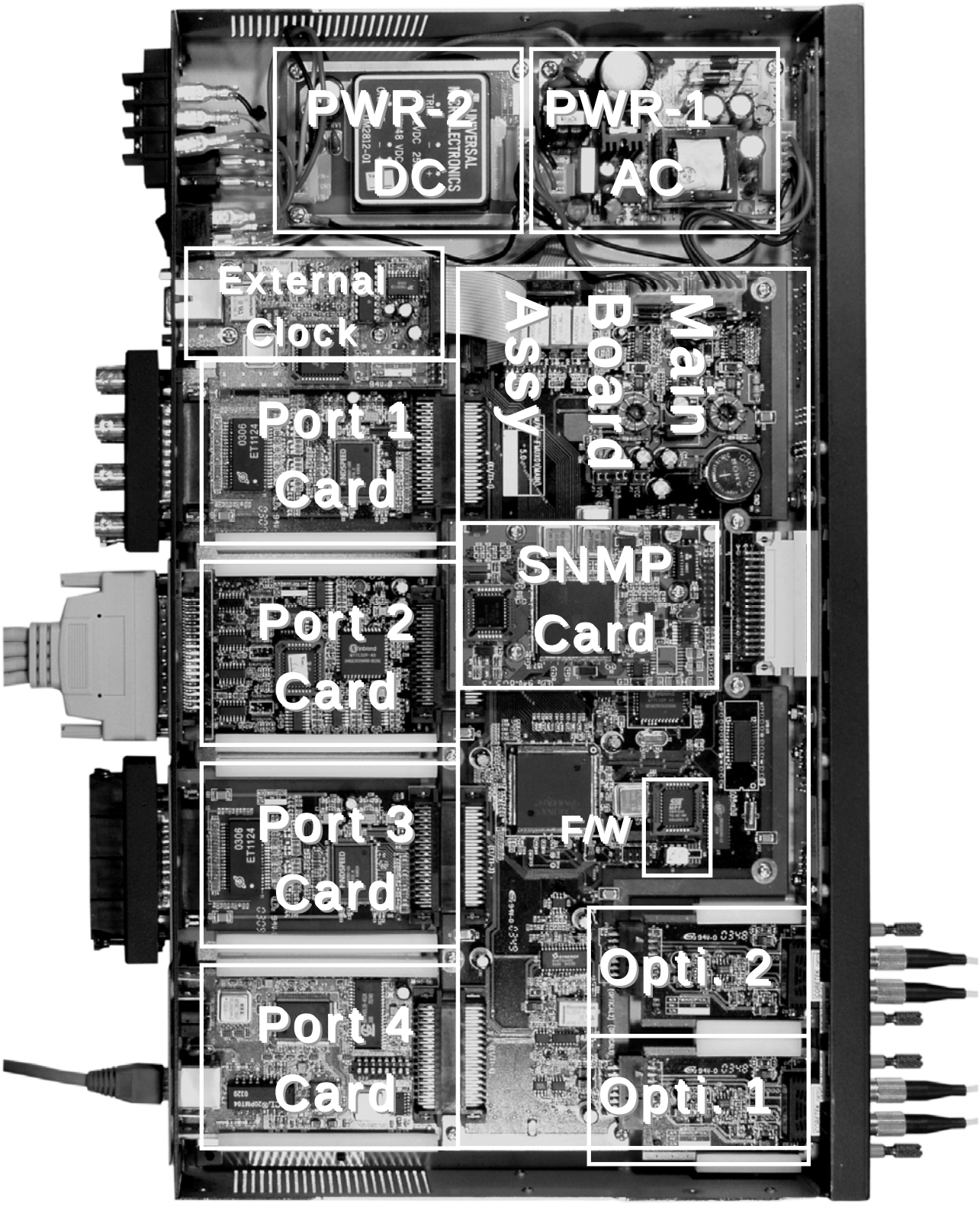

Figure 1-1 : *Fiber Multiplexer* Major Components

1.3 Technical Specifications

E1 Link

Framing	Unframed (transparent*)
Bit Rate	2.048 Mb/s
Line Code	AMI
	HDB3
Line Impedance	Unbalanced 75 ohms (BNC)
	Balanced 120 ohms (RJ-45)
Receiver sensitivity	+3 to -12dB (short haul)
"Pulse" Amplitude	Nominal 2.37V+/-10% for 75 ohms
	Nominal 3.00V+/-10% for 120 ohms
"Zero" Amplitude	+/-0.3V
Transmit Frequency Tracking	(w/external clock card option)
Internal Timing	+/-30 ppm
Jitter Performance	According to ITU-T G.823
Performance monitoring	According to ITU-T G.821
Complies With	ITU-T G.703, G.704, G.706 and G.732
Interface Connectors	RJ-45 (wire wrap connector also available)
	BNC
Test Loops	LLB (Local Loop Back)
	NELB (Near End Loop Back)
	RLB (Remote Loop Back)
	RRLB (Request Remote Loop Back)

* Transparent to framing (ITU-T G.704); transparent to ISDN PRI (30B+1D) E1 transmissions

T1 Link

Framing	Unframed (transparent)
Bit Rate	1.544 Mb/s
Line Code	AMI
	B8ZS
Line Impedance	Balanced 100 ohms (RJ-45)
Receiver sensitivity	+3 to -12dB (short haul)
"Pulse" Amplitude	Nominal 3.00V+/-10% for 100 ohms
"Zero" Amplitude	+/-0.3V
Transmit Frequency Tracking	(w/external clock card option)
Internal Timing	+/-30 ppm
Jitter Performance	According to ITU-T G.824
Performance monitoring	According to ITU-T G.821
Complies With	ITU-T G.703, G.704, G.706 and G.733
Interface Connectors	RJ-45 (wire wrap connector also available)
Test Loops	LLB (Local Loop Back)
	NELB (Near End Loop Back)
	RLB (Remote Loop Back)
	RRLB (Request Remote Loop Back)

Optical Interface

Bit Rate	51.84Mbps
Line code	Scrambled NRZ
Protection	1+1 redundant, hot swappable modules
Switch over time	<50ms

Data Port Channels

Interface Types	V.35 X.21 RS-530/V.36 RS-449 RS-232
Interface Connectors	(provided by 1 to 4 header adapter cables)
V.35 Interface	34 pin, Female or Male
X.21 Interface	15 pin, D-type Female or Male
RS-530 Interface	25 pin, D-type Female or Male
RS-449 Interface	37 pin, D-type Female or Male
RS-232 Interface	25 pin, D-type Female or Male
Line Code	NRZ
Data Rate (each channel)	nx64Kb/s (64 ~ 2048Kb/s) where n equal 1 to 32 RS-232 maximum is 128Kb/s
Clock Modes	Transparent, recovery, External, or Internal
Control Signals	CTS constantly ON or follows RTS DSR constantly ON, except during test loops DCD constantly ON, except during signal loss
Test Loops	LLB (Local Loop Back) RLB (Remote Loop Back) V.54

Bridge Port Channels

Interface Type	10Base-T, 100Base-TX (auto-negotiation)
Interface Connector	RJ-45
WAN Data Rate	8.192Mb/s
Complies with	IEEE802.3 10Base-T IEEE802.3u 100Base-TX
Configuration modes	bridge/repeater, full/half, 10/100, auto
Test Loops	NONE

Local Setup and Configuration

LCD	2 rows of 16 characters
Pushbutton Switches	ESC Left Arrow (-) Right Arrow (+) Enter

Alarm Output Relays

Alarm Output	Four pairs of Normally Open contacts for Major and Minor alarms, both audio and visual. Contact ratings: 1A at 30 VDC resistive or 0.5A at 125 VAC resistive
Pin Assignment (DB9F)	1 - 2 / Major (audio) 3 - 4 / Major (visual) 5 / frame ground 6 - 7 / Minor (audio) 8 - 9 / Minor (visual)

LED Indicators

Power 1	Green	Power Module 1 active
Power 2	Green	Power Module 2 active
Optical 1	Amber	Off = off On = working (ALS is off) On = working & linked (ALS is set Auto) Blinking = working & not linked (If ALS is disabled, then the not linked condition will not be indicated by a blinking LED)
Optical 2	Amber	Off = disabled On = standby (ALS is off) On = standby & linked (ALS is set Auto) Blinking = Standby & not linked (If ALS is disabled, then the not linked condition will not be indicated by a blinking LED)
Channels	GREEN	One LED for each channel (A-D) of each Port (1-4) or a total of 16 LED. On = In Service Off = Out of Service Blinking = Loss of Signal
Audible Alarm Cutoff	Amber	Audible Alarm has sounded, alarm cutoff switch has been pushed
Minor Alarm	Amber	Indicates a minor alarm has occurred, includes E1 or T1 BPV or fiber sync slip.
Major Alarm	RED	Indicates a major alarm has occurred, includes E1, T1, and fiber signal loss.
Far End Error	Amber	Indicates a far end (remote) error has occurred
Near End Error	RED	Indicates a near end (local) error has occurred
System Failure	RED	Indicates a failure in the "system" such as fiber LOS
Optical	(Dual)	GREEN = optical link established RED = optical link failure
E1	(Dual)	GREEN = E1 active, no error RED = E1 Signal Loss Off = No E1
T1	(Dual)	GREEN = T1 active, no errors RED = T1 Signal Loss Off = No T1

RS-232 Console Port

Port interface	RS-232D asynchronous, DCE
Port connector	RJ-45
Data rate (*default)	19200 bps
Data format	-One start bit -8 data bits -No parity -One stop bit

RJ-45 Pin Usage

RJ-45(DCE)		DB9(DTE)
4	GND	5
5	TD	2
6	RD	3

Optical Specifications (secondary fiber need not be identical to primary)

		Standard Types					WDM Types*			
Type		M-M	S-M	S-M	S-M	S-M	S-M	S-M	S-M	S-M
Distance (Km)		2	15	30	50	120	20(A)*	20(B)*	40(A)*	40(B)*
Wavelength (nm)		1310	1310	1310	1310	1550	**Tx:1310 Rx:1550**	**Tx:1550 Rx:1310**	**Tx:1310 Rx:1550**	**Tx:1550 Rx:1310**
BER**		$<10^{-11}$	$<10^{-11}$	$<10^{-11}$	$<10^{-11}$	$<10^{-11}$	$<10^{-11}$	$<10^{-11}$	$<10^{-11}$	$<10^{-11}$
Sensitivity		**-31dBm**	**-32dBm**	**-35dBm**	**-36dBm**	**-35dBm**	**-32dBm**	**-32dBm**	**-32dBm**	**-32dBm**
Output Power		**-20dBm**	**-20dBm**	**-15dBm**	**-8dBm**	**0dBm**	**-18dBm**	**-15dBm**	**-10dBm**	**-7dBm**
Power Margin		**11dB**	**12dB**	**20dB**	**28dB**	**35dB**	**14dB**	**17dB**	**22dB**	**25dB**
Return Loss		**-12dBm**	**-12dBm**	**-12dBm**	**-12dBm**	**-12dBm**	**-14dBm**	**-14dBm**	**-14dBm**	**-14dBm**
Conn. Types	ST	v	v	v	v	v				
	SC	v	v	v	v	v	v	v	v	v
	LC	v	v	v	v	v				
	MT-RJ	v	v	v	v	v				
	FC	v	v	v	v	v				

M-M: multi-mode S-M: single-mode [All optical transceivers are rated Class A.]
* WDM types must match (A) with (B) in pairs
** Bit Error Rate

All fiber transceivers in the Multiplexer incorporate an automatic laser shutdown feature (ALS) designed to protect personnel that may come into contact with a disconnected fiber connection. This feature may also be disabled for testing purposes via the front panel LCD, console terminal mode or SNMP (when SNMP option is installed). The fiber module ports may be independently installed with any of the above fiber features and must only match the remote side's module. Fiber modules are completely hot swappable and may be replaced in the field without taking the unit out of service.

Physical

Height:	43 mm (1.75")
Width:	438 mm (17.25")
Depth:	251 mm (9.875")
Weight:	4.5 kg (10 lb.) Net

Power supply

Voltage (AC source)	90 ~ 250 VAC
Voltage (DC source)	20 ~ 60 VDC
Frequency	47 to 63 Hz for AC power
Power consumption	40 VA (~ 40 watts)

Environment

Temperature	0-50° C / 32-122° F
Humidity	0 to 90% non-condensing
Heat Dissipation	<100 BTU/hr

Miscellaneous

MTBF	87,116 hours (+/- 5%)
Emission compliance	meets FCC part 15 Sub B (class A) EN55022:1994/A1:1995/A2:1997, EN61000-3-2:1995, EN61000-3-3:1995, and EN50082-1:1997

1.4 E1 Signal Structure

E1 link line rate

The E1 line operates at a nominal rate of 2.048Mb/s.

E1 link line coding

The basic E1 line signal is coded using either the **Alternate Mark Inversion** (AMI) or **HDB3** rule.

In the AMI format, "ones" are alternately transmitted as positive and negative pulses, whereas "zeros" are transmitted as a zero voltage level. AMI is not used in most 2.048Mb/s transmissions because synchronization loss occurs during long strings of data zeros.

In the HDB3 format, a string of four consecutive zeros is replaced with a substitute string of pulses containing an intentional bipolar violation. The HDB3 code substitutions provide high pulse density so that the receiving equipment is able to maintain synchronization with the received signal.

The ***4-CHANNEL E1 Port Card*** supports two E1 line codes:

AMI coding.

HDB3 coding.

The ***4-CHANNEL E1 Port Card*** supports only transparent unframed format. ie. The E1 will pass through with its original framing structure completely intact.

1.5 T1(DS1) Signal Structure

T1 link line rate

The T1 line operates at a nominal rate of 1.544Mb/s.

T1 link line coding

The basic T1 line signal is coded using either the **Alternate Mark Inversion** (AMI) or **B8ZS** rule.

In the AMI format, "ones" are alternately transmitted as positive and negative pulses, whereas "zeros" are transmitted as a zero voltage level. AMI is not used in most 1.544Mb/s transmissions because synchronization loss occurs during long strings of data zeros.

In the B8ZS format, a string of eight consecutive zeros is replaced with a substitute string of pulses containing an intentional bipolar violation. The B8ZS code substitutions provide high pulse density so that the receiving equipment is able to maintain synchronization with the received signal.

The ***4-CHANNEL T1 Port Card*** supports two T1 line codes:

AMI coding.

B8ZS coding.

The ***4-CHANNEL T1 Port Card*** supports only transparent unframed format. ie. The T1 will pass through with its original framing structure completely intact.

1.6 Applications / Capabilities

In the following example, the ***Fiber Multiplexer*** utilizes an optical fiber connection between a pair of units to provide 4, 8, 12 or 16 channels of E1, T1, Datacom, or 1 to 4 channels of Ethernet Bridge between the units.

The timing scheme for typical E1 or T1 equipment is to transparently pass timing from a timing source unit on one side, to a timing slaved unit on the other. Each of the up to 16 available channels of the ***Fiber Multiplexer*** is independent of any other channel for framing or timing. For datacom channels (V.35, X.21, etc.) full timing configuration is possible to either provide clock, receive clock or to transparently pass clock from one device to the other.

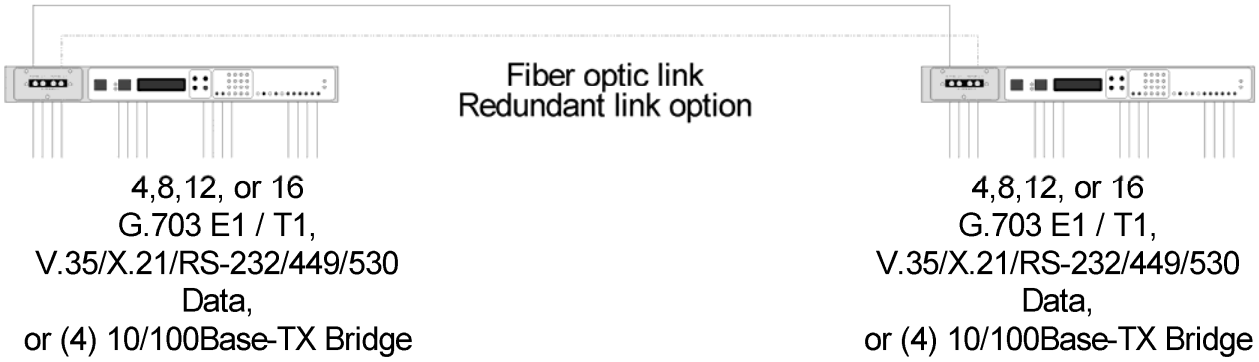

Figure 1-2 : Typical Point-to-Point Application of *Fiber Multiplexer*

Chapter 1. Introduction

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Chapter 2. Port Card Overview

2.1 Introduction

This chapter provides a more descriptive over-view of the available **4-Channel Port card** options. Detailed specifications are in Chapter 1, while removal and replacement procedures are detailed in Chapter 3. Unit configuration is all covered in Chapter 4. The cards are NOT designed to be "hot" swappable, therefore make sure the ***Fiber Multiplexer*** chassis is powered off before replacing a card or pulling it from the chassis. Removal and installation of **4-Channel Port Cards** with the rack chassis under power is **NOT RECOMMENDED** and will definitely effect the operation of the other **4-Channel Port Cards** (insertion and removal cannot be recognized by the ***Fiber Multiplexer***).

2.2 Port Card Overview

The **4-Channel Port Cards** for the ***Fiber Multiplexer*** are modular PCAs which slide into the ***Fiber Multiplexer*** chassis, and interface with the internal "main board". The main board provides an interface connection to the **4-Channel Port Cards** for power, data connection and other logic (for local management terminal and optional SNMP).

2.3 4 x E1 I/F Module Overview

The 4 x E1 4-Channel Port Cards for the ***Fiber Multiplexer*** are modular PCAs which slide into the ***Fiber Multiplexer*** chassis and provide four completely independent ITU-T G.703 E1 interfaces. The PCA module terminates with a DB25F connector that is designed to connect to a physical adapter. The adapter is available in two options, one, with 4 pairs of BNC connectors for 75 Ohm unbalanced connections and the other with four RJ-45 jacks for 120 Ohm balanced connections.

2.4 4 x T1 I/F Module Overview

The 4 x T1 4-Channel Port Cards for the ***Fiber Multiplexer*** are modular PCAs which slide into the ***Fiber Multiplexer*** chassis and provide four completely independent T1(DS1) interfaces. The PCA module terminates with a DB25F connector that is designed to connect to a physical adapter. The adapter is available with four RJ-45 jacks for 100 Ohm balanced connections.

2.5 External Clock Overview

The ***Fiber Multiplexer*** is available with an external clock option that allows the unit to be synchronized with external clocks or equipment. The ***Fiber Multiplexer*** may receive an external clock source from E1 PCM, E1 TTL, T1 PCM or T1 TTL signal sources. Additionally, the option includes its own precision crystal based clock. The external clock is received via an RJ-45 jack from the rear panel.

Ext Clk
1. Rx - (RRing)
2. Rx + (RTip)

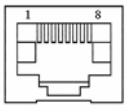


Figure 2-1. External Clock Connector

2.6 4 x Data I/F Module Overview

The 4 x Data 4-Channel Port Cards for the ***Fiber Multiplexer*** are modular PCAs which slide into the ***Fiber Multiplexer*** chassis and provide four completely independent Data (V.35, X.21, RS-530, RS-449, or RS-232) interfaces. The PCA module terminates with a HD62F connector that is designed to connect to a physical adapter. The Data module is available in one of ten interface and cable options.

1. 4 x V.35 with 4 MB34 Female connectors
2. 4 x V.35 with 4 MB34 Male connectors
3. 4 x X.21 with 4 DB15 Female connectors
4. 4 x X.21 with 4 DB15 Male connectors
5. 4 x RS-530 with 4 DB25 Female connectors
6. 4 x RS-530 with 4 DB25 Male connectors
7. 4 x RS-449 with 4 DB37 Female connectors
8. 4 x RS-449 with 4 DB37 Male connectors
9. 4 x RS-232 with 4 DB25 Female connectors
10. 4 x RS-232 with 4 DB25 Male connectors

When the ***Fiber Multiplexer*** is ordered with an **X21 Port Card** option, a **4-CHANNEL X.21 Card** and adapter cable are supplied with each DB15 wired according to the following table.

Signal Function	DB15 PIN#	Abbreviation	Direction	Description
Shield	1	FG	<->	Chassis ground. May be isolated from signal ground.
Ground	8	SG	<->	Common signal ground.
Transmit(A) Transmit(B)	2 9	TD(A) TD(B)	To ***MUX UNIT***	Serial digital data from DTE.
Receive(A) Receive(B)	4 11	RD(A) RD(B)	Fm. ***MUX UNIT***	Serial digital data at the output of the ***Fiber Multiplexer*** receiver.
Control(A) Control(B)	3 10	RTS(A) RTS(B)	To ***MUX UNIT***	A ON signal to the ***Fiber Multiplexer*** when data transmission is desired.
Indication(A) Indication(B)	5 12	DCD(A) DCD(B)	Fm. ***MUX UNIT***	Constantly ON, except when a loss of the received carrier signal is detected.
Ext. Timing(A) Ext. Timing(B)	7 14	ETC(A) ETC(B)	To ***MUX UNIT***	A transmitted data rate clock input from the data source.
Signal Timing(A) Signal Timing(B)	6 13	RC(A) RC(B)	Fm. ***MUX UNIT***	A received data rate clock for use by an external data source.

Table 2-1 : DB15 adapter cable pin out for X.21

Chapter 2. Port Card Overview

When the ***Fiber Multiplexer*** is ordered with an **V35 Port Card** option, a **4-CHANNEL V.35 Card** and adapter cable are supplied with each MB34 wired according to the following table.

Signal Function	MB34 PIN#	V.35 Circuit	Direction	Description
Frame Ground	A	Frame	<->	Chassis ground. May be isolated from signal ground.
Signal Ground	B	Signal Ground	<->	Common signal ground.
Transmit Data	P S	TD(A) TD(B)	To ***MUX UNIT***	Serial digital data from DTE.
Receive Data	R T	RD(A) RD(B)	Fm. ***MUX UNIT***	Serial digital data at the output of the ***Fiber Multiplexer*** receiver.
Request To Send	C	RTS	To ***MUX UNIT***	A ON signal to the ***Fiber Multiplexer*** when data transmission is desired.
Clear To Send	D	CTS	Fm. ***MUX UNIT***	Constantly ON.
Data Set Ready	E	DSR	Fm. ***MUX UNIT***	Constantly ON, Except during test loops.
Data Terminal Ready	H	DTR	To ***MUX UNIT***	DTR not used, used for a received serial data rate clock input from the DTE.
Data Carrier Detect	F	DCD	Fm. ***MUX UNIT***	Constantly ON, except when a loss of the received carrier signal is detected.
External Transmit Clock	U W	ETC(A) ETC(B)	To ***MUX UNIT***	A transmitted data rate clock input from the data source.
Transmit Clock	Y AA	TC(A) TC(B)	Fm. ***MUX UNIT***	A transmitted data rate clock for use by an external data source.
Receive Clock	V X	RC(A) RC(B)	Fm. ***MUX UNIT***	A received data rate clock for use by an external data source.
Remote Loopback	HH	RL	To ***MUX UNIT***	When on, commands ***Fiber Multiplexer*** into remote loop back.
Local Loopback	JJ	LL	To ***MUX UNIT***	When on, commands ***Fiber Multiplexer*** into local loop back.
Test Indicator	KK	TM	Fm. ***MUX UNIT***	ON during any test mode

Table 2-2 : MB34 cable pin out for V.35

Chapter 2. Port Card Overview

When the ***Fiber Multiplexer*** is ordered with an **RS449 Port Card** option, a **4-CHANNEL RS-449 Card** and adapter cable are supplied with each DB37 wired according to the following table.

SIGNAL FUNCTION	DB37 PIN	RS-449 CIRCUIT	Direction	DESCRIPTION
Protective Ground	1	Frame	<->	Chassis ground. May be isolated from signal ground.
Signal Ground	19,20, 37	SG,RC, SC	<->	Common signal ground.
Transmitted Data	4 22	SD(A) SD(B)	To ***MUX UNIT***	Serial digital data from DTE.
Received Data	6 24	RD(A) RD(B)	Fm. ***MUX UNIT***	Serial digital data at the output of the ***Fiber Multiplexer*** receiver.
Request to Sent	7 25	RS(A) RS(B)	To ***MUX UNIT***	A ON signal to the ***Fiber Multiplexer*** when data transmission is desired.
Clear to Sent	9 27	CS(A) CS(B)	Fm. ***MUX UNIT***	Constantly ON.
Data Set Ready	11 29	DM(A) DM(B)	Fm. ***MUX UNIT***	Constantly ON, Except during test loops.
Data Terminal Ready	12 30	TR(A) TR(B)	To ***MUX UNIT***	DTR not used, used for a received serial data rate clock input from the DTE.
Data Carrier Detect	13 31	RR(A) RR(B)	Fm. ***MUX UNIT***	Constantly ON, except when a loss of the received carrier signal is detected.
External Transmit clock	17 35	TT(A) TT(B)	To ***MUX UNIT***	A transmitted data rate clock input from the data source.
Transmit Clock	5 23	ST(A) ST(B)	Fm. ***MUX UNIT***	A transmitted data rate clock for use by an external data source.
Receive Clock	8 26	RT(A) RT(B)	Fm. ***MUX UNIT***	A received data rate clock for use by an external data source.
Remote Loop back	14	RL	To ***MUX UNIT***	When on, commands ***Fiber Multiplexer*** into remote loop back.
Local Loop back	10	LL	To ***MUX UNIT***	When on, commands ***Fiber Multiplexer*** into local loop back.
Test Indicator	18	TM	Fm. ***MUX UNIT***	ON during any test mode

Table 2-3 : DB37 adapter cable pin out for RS-449

Chapter 2. Port Card Overview

When the ***Fiber Multiplexer*** is ordered with an **RS530 Port Card** option, a **4-CHANNEL RS-530 Card** and adapter cable are supplied with each DB25 wired according to the following table.

SIGNAL Function	DB25 PIN	CIRCUIT	DIRECTION	DESCRIPTION
Protective Ground	1	Frame	<->	Chassis ground. May be isolated from signal ground.
Signal Gnd	7	AB	<->	Common signal ground.
Transmitted Data	2 14	BA(A) BA(B)	To ***MUX UNIT***	Serial digital data from DTE.
Received Data	3 16	BB(A) BB(B)	Fm ***MUX UNIT***	Serial digital data at the output of the ***Fiber Multiplexer*** receiver.
Request to Sent	4 19	CA(A) CA(B)	To ***MUX UNIT***	A ON signal to the ***Fiber Multiplexer*** when data transmission is desired.
Clear to Sent	5 13	CB(A) CB(B)	Fm ***MUX UNIT***	Constantly ON.
Data Set Ready	6 22	CC(A) CC(B)	Fm ***MUX UNIT***	Constantly ON, Except during test loops.
Data Terminal Ready	20 23	CD(A) CD(B)	To ***MUX UNIT***	DTR not used, used for a received serial data rate clock input from the DTE.
Data Carrier Detect	8 10	CF(A) CF(B)	Fm ***MUX UNIT***	Constantly ON, except when a loss of the received carrier signal is detected.
External Transmit clock	24 11	DA(A) DA(B)	To ***MUX UNIT***	A transmitted data rate clock input from the data source.
Transmit Clock	15 12	DB(A) DB(B)	Fm ***MUX UNIT***	A transmitted data rate clock for use by an external data source.
Receive Clock	17 9	DD(A) DD(B)	Fm ***MUX UNIT***	A received data rate clock for use by an external data source.
Remote Loop back	21	RL	To ***MUX UNIT***	When on, commands ***Fiber Multiplexer*** into remote loop back.
Local Loop back	18	LL	To ***MUX UNIT***	When on, commands ***Fiber Multiplexer*** into local loop back.
Test Indicator	25	TM	Fm ***MUX UNIT***	ON during any test mode

Table 2-4 : DB25 adapter cable pin out for RS-530

Chapter 2. Port Card Overview

When the ***Fiber Multiplexer*** is ordered with an **RS232 Port Card** option, a **4-CHANNEL RS-232 Card** and adapter cable are supplied with each DB25 wired according to the following table.

Signal Function	DB25 PIN	Circuit	Direction	Description
Protective Ground	1	AA	<->	Chassis ground. May be isolated from signal ground.
Signal Ground	7	AB	<->	Common signal ground.
Transmitted Data	2	BA	To ***MUX UNIT***	Serial digital data from DTE.
Received Data	3	BB	Fm ***MUX UNIT***	Serial digital data at the output of the ***Fiber Multiplexer*** receiver.
Request to Sent	4	CA	To ***MUX UNIT***	A ON signal to the ***Fiber Multiplexer*** when data transmission is desired.
Clear to Sent	5	CB	Fm ***MUX UNIT***	Constantly ON.
Data Set Ready	6	CC	Fm ***MUX UNIT***	Constantly ON, Except during test loops.
Data Terminal Ready	20	CD	To ***MUX UNIT***	DTR not used, used for a received serial data rate clock input from the DTE.
Data Carrier Detect	8	CF	Fm ***MUX UNIT***	Constantly ON, except when a loss of the received carrier signal is detected.
External Transmit Clock	24	DA	To ***MUX UNIT***	A transmitted data rate clock input from the data source.
Transmit Clock	15	DB	Fm ***MUX UNIT***	A transmitted data rate clock for use by an external data source.
Receive Clock	17	DD	Fm ***MUX UNIT***	A received data rate clock for use by an external data source.
Remote Loop back	21	RL	To ***MUX UNIT***	When on, commands ***Fiber Multiplexer*** into remote loop back.
Local Loop back	18	LL	To ***MUX UNIT***	When on, commands ***Fiber Multiplexer*** into local loop back.
Test Indicator	25	TM	Fm ***MUX UNIT***	ON during any test mode

Table 2-5 : DB25 adapter cable pin out for RS-232

2.7 Ethernet Bridge Module Option

When the ***Fiber Multiplexer*** is ordered with an **ET100 Port Card** option, a Single-Channel Bridge Port Card is supplied. Complete bridging functions are provided.

BRIDGE FEATURES

10BASE-T/100BASE-TX, Full Duplex or Half Duplex
HP Auto-MDIX, detects and corrects crossed cables
IEEE 802.3x flow control available
Real-time filtering with 256 address tables
Automatic address learning, aged and deleted with 5 minutes
Up to 340 packet-buffering capacity
Auto pads undersize packets to meet the minimum LAN packet size requirement
Buffering modes can be selected according to the set of WAN and LAN line speeds
Automatic TP polarity correction
Supports passing of VLAN tab packets

BRIDGE SPECIFICATIONS

Compliance:	IEEE 802.3/802.3u
Connector:	Shielded RJ-45
Data Rate:	10/100Mbps; Half Duplex (20/200Mbps; Full duplex)
Filtering and Forwarding:	wire speed
Delay:	1 frame
WAN Protocol:	HDLC

Filter:

When this feature is disabled (DIP1-1 OFF), all frames are passed transparently. In this configuration, the **ET100** acts as an Ethernet repeater. When the filter is enabled (DIP-1 ON), frame destinations are tested against the internal MAC address table. Filtering enabled is the normal selection for Bridging. When operating with modern switching HUB equipment, there is no need to enable the filtering function as the switching HUB will do the necessary filtering. In repeater mode, the small MAC address table (256) is not required and the unit can function in a large network without regard to MAC filtering. The module is set to repeater mode from the factory.

Auto Negotiation:

When this feature is enabled (DIP1-3 OFF), the LAN Duplex (DIP1-4) and Speed (DIP1-5) settings are ignored. In this default setting, the bridge will try to determine the proper speed and duplex mode of the connected device. This is the preferred method of configuration, and does not require the specific knowledge of the capabilities of the device to which the bridge is connected. For legacy equipment that does not support auto-negotiation, it is highly recommended to place DIP1-3 in the ON position and manually adjust the LAN duplex (DIP1-4) and speed (DIP1-5) configuration settings. Failure to make the proper Ethernet settings can result in reduced LAN performance or in worst case, no LAN function at all.

Duplex:

The original specifications for Ethernet did not allow any bi-directional transmissions. The Ethernet operated in a half duplex mode. Modern Ethernet has the ability to operate in Full duplex mode which essentially doubles the throughput from 10Mbps to 20Mbps on 10Base-T or from 100Mbps to 200Mbps on 100Base-TX. Using this setting requires connection to equipment which also supports Full duplex Ethernet. Setting DIP1-4 OFF will enable this Full duplex mode. However, if Auto-negotiation is enabled (DIP1-3 OFF), then this switch's setting is ignored.

Speed:

DIP1-5 is used to set the Ethernet speed at 10Mbps (10Base-T) or 100Mbps (100Base-TX). When set ON, the Ethernet connection will operate in the slower 10Base-T speed. When DIP1-5 is set OFF, the Ethernet connection will operate at 100Base-TX speed. However, if Auto-negotiation is enabled (DIP1-3 OFF), then this switch's setting is ignored.

Auto MDI:

Auto MDI is a new Ethernet feature which allows Ethernet connections between MDI devices and/or MDI-X devices (HUBs) all using only straight thru, one-to-one, UTP connections. When DIP1-6 is ON, this feature is enabled. When this feature is disabled (DIP1-6 OFF), the device becomes MDI only and requires a crossover UTP cable to connect to another MDI device (such as PCs). Straight cable connections are used for connecting to MDI-X devices such as HUBs.

DIP Switch Settings

DIP	State		Function
1	ON		Enable MAC filtering
	OFF*		Disable Filtering (repeater)
2	ON		Enable 802.3x flow control
	OFF*		Disable 802.3x flow control
3	ON		NO Auto-negotiation
	OFF*		Auto-negotiation
4	ON		Half Duplex[1]
	OFF*		Full Duplex[1]
5	ON		10BASE-T LAN speed[1]
	OFF*		100BASE-TX LAN speed[1]
6	ON*		Enable Auto MDIX
	OFF		MDI (1:1 to HUB)
7 | 8	OFF	OFF	Memory configuration #1
	ON	OFF	Memory configuration #2*
	OFF	ON	Memory configuration #3
	ON	ON	Reserved

Table 2-6 DIP switch settings

* factory default settings

[1] no effect when sw3 is off (auto-negotiation is on).

LED Indicators

Designation	Indication
Full (yellow)	ON=Full Duplex
Link (green)	ON=LAN Link
Error (red)	ON=LAN Error
100M (yellow)	ON=Fast Ethernet
Receive (yellow)	ON=LAN Rx data
Transmit(yellow)	ON=LAN Tx data

Table 2-7 LED indicators

Memory configuration detail

#1 LAN to WAN 308 packets, WAN to LAN 32 packets
#2 LAN to WAN 170 packets, WAN to LAN 170 packets
#3 LAN to WAN 32 packets, WAN to LAN 308 packets

MDI
1. Tx +
2. Tx -
3. Rx +
6. Rx -

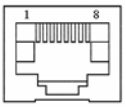


Table 2-8 ET100 pin allocation

Chapter 3. Installation

3.1 General

This chapter explains in detail the requirements and procedures for the installation of the ***Fiber Multiplexer*** Standalone/Rack Mount Fiber Optical Multiplexer.

3.2 Site Preparation

Install the ***Fiber Multiplexer*** within reach of an easily accessible grounded AC outlet. The outlet should be capable of furnishing 90 to 250 VAC (20 to 60 VDC for DC supply). Allow at least 10cm (4 inch) clearance at the rear and front of the ***Fiber Multiplexer*** for signal lines and interface cables.

3.3 Mechanical Assembly

The ***Fiber Multiplexer*** is designed for rack mount installation and only requires 1U space (1 3/4") in a standard EIA 19 or 23 inch rack. It is highly recommended that the unit be placed in a rack. The ***Fiber Multiplexer*** may or may not be delivered completely assembled. No provision is made for bolting the ***Fiber Multiplexer*** to a tabletop.

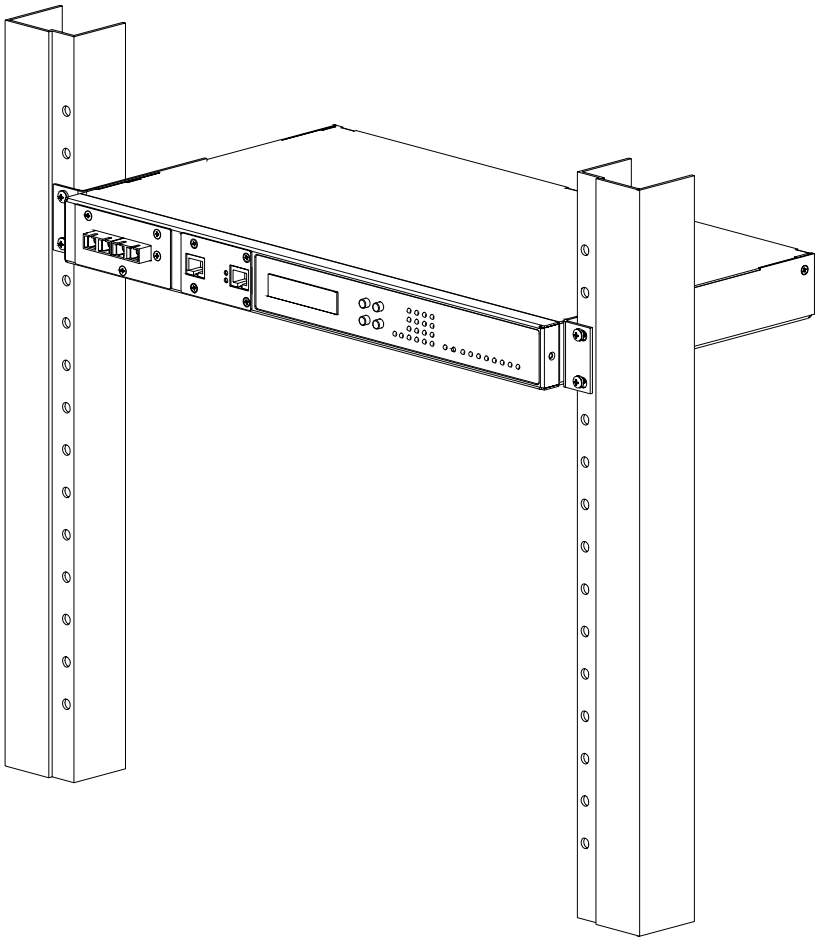


Figure 3-1 : Rack mount Installation of the *Fiber Multiplexer*

3.4 Electrical Installation

3.4.1 Power connection

For a model with AC power supply, AC power (90~250VAC) is supplied to the ***Fiber Multiplexer*** through a standard IEC 3-prong receptacle, located on the rear of the chassis. For a model with DC power supply, DC –48V (20~60VDC) is connected to the terminal block, observing the proper polarity. In the AC/DC model, both IEC receptacle and DC terminal block are provided for dual power operation. The ***Fiber Multiplexer*** should always be grounded through the protective earth lead of the power cable in AC installations, or via the frame ground connection for DC installations.

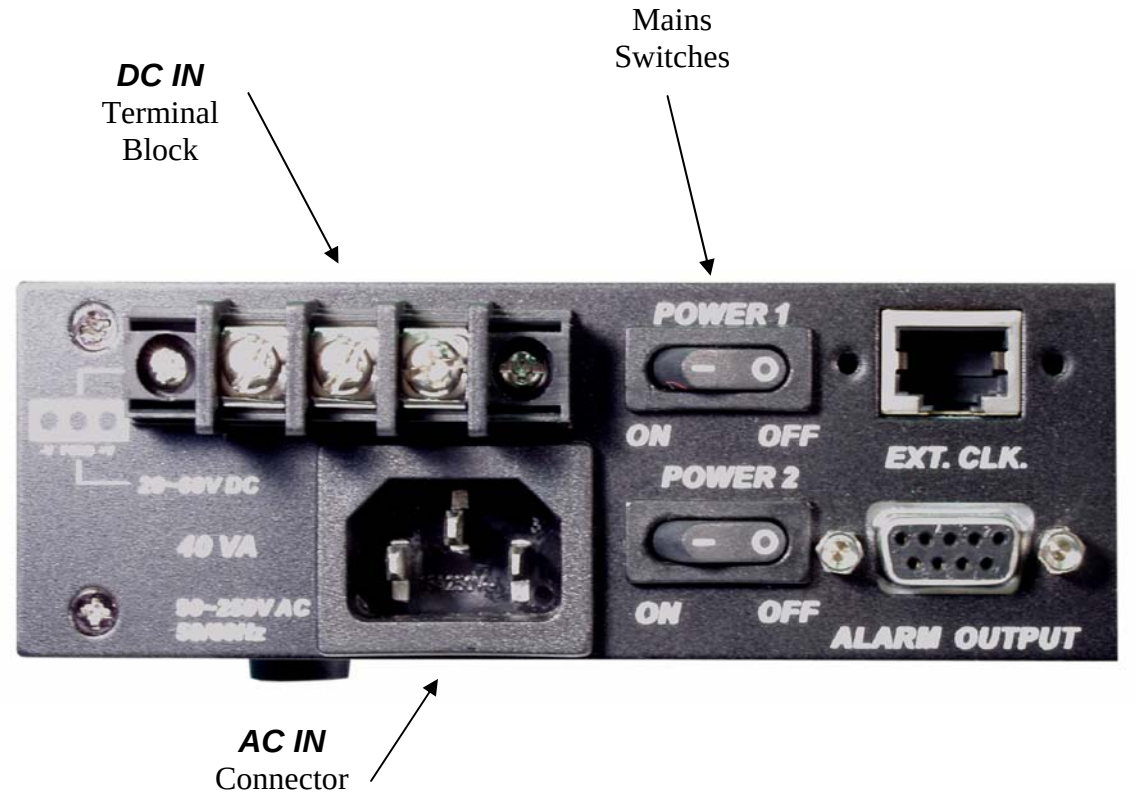


Figure 3-2 : Supply connections, AC/DC model shown

3.4.2 Rear and Front panel connectors

All 4-Channel Port Cards install into the rear of the ***Fiber Multiplexer***. The back plane provides both DC power to the 4-CHANNEL Port interface cards and routes signals from the cards to the multiplexing circuitry. From here, the multiplexed signal is sent to the Fiber Interface modules installed in the front panel.

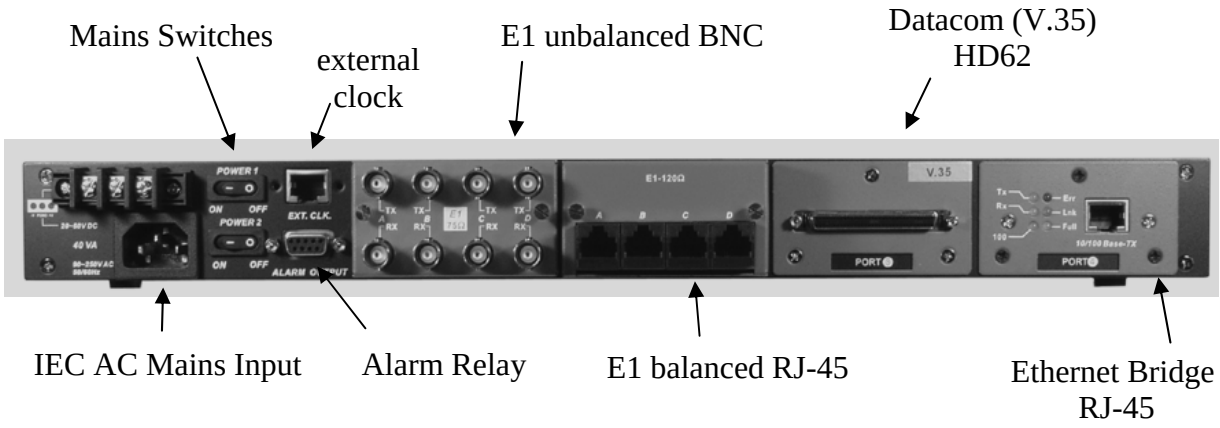


Figure 3-3 : Rear Panel Connections

The front panel of the ***Fiber Multiplexer***, holds the optical interfaces, LCD display, menu keypad, LCD contrast trimmer and the status and alarm LEDs. On the optical interface, two interface connector groups are provided for connection to either the primary optical transmit and receive pair or to the redundant optical transmit and receive pair (if the optical interface card has the redundant optical option). The front panel also provides the connections to the RS-232 Console Interface (terminal mode) and to the LAN network for SNMP control (when the SNMP option is installed).

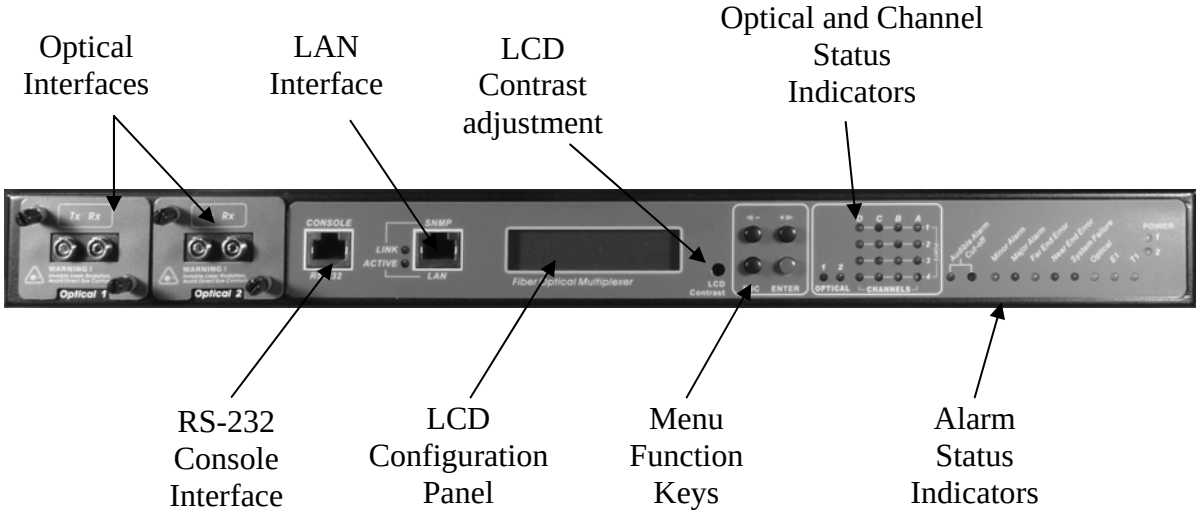


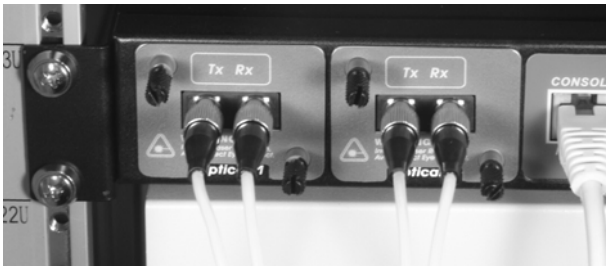
Figure 3-4 : Front Panel Controls and Indicators

3.5 Removal/Replacement Procedures

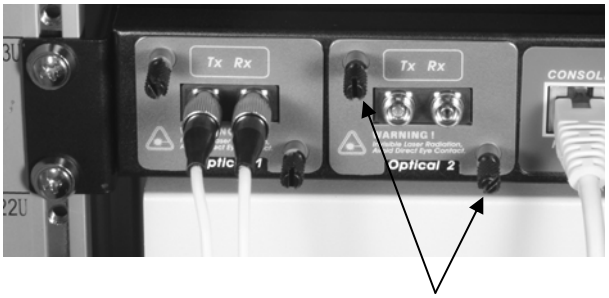
3.5.1 Optical Module Removal / Replacement (Hot Swappable)

The optical interfaces are installed into the front of the ***Fiber Multiplexer***. The front plane connectors of the internal mainboard provide both DC power to the optical interface cards and routes signals from the cards to the multiplexing/de-multiplexing circuitry. Two separate modular interfaces are provided for connection to the primary optical transmit and receive pair and to the redundant optical transmit and receive pair (if the redundant optical interface module is installed). From here, the de-multiplexed signals are sent to the individual 4-CHANNEL Card module/channel installed in the rear of the unit (see 3-5-2 for removal/replacement procedures).

To remove either interface module, loosen the captive thumb screws until the threads are disengaged from the chassis. Gently pull the card straight forward by the captive screws using equal force to avoid binding. The card is only held by the friction of the connector. To install an optical module, reverse the procedure, taking care when seating the module to avoid connector damage. Gently, don't force it! Re-tighten the captive screws but don't over-tighten.

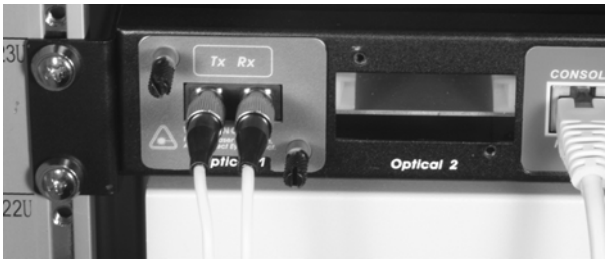


Remove fiber cables



Loosen the captive screws.

Pull out the module by the captive screws.



Reverse the procedure with replacement.

Figure 3-5 : Optical Interface Removal / Replacement (while in service)

3.5.2 Channel Port I/F Module Removal / Replacement

****CAUTION**** All the following removal/replacement procedures must be done with all power sources disconnected.

All 4-Channel Port Cards install into the rear of the ***Fiber Multiplexer***. The channel connector for E1/T1 is held by two "thumb" screws. Loosen both thumb screws (use a flat blade screwdriver if they are too tight), then remove the connector adapter by gently pulling straight back. The 4-Channel Port cards are held in by three small flathead screws. Using a No.2 Philips screwdriver, remove the two upper and one lower screw, then pull the module straight out (refer to the pictures below). To install the 4-Channel Port module, reverse the procedure, taking care when seating the module to avoid connector damage. Gently seat it, do not force it! Re-install the three flathead screws and do not over-tighten. Then re-install the appropriate channel adapter and tighten the thumb screws gradually and evenly. Tightening lightly with screwdriver if by hand is insufficient.

Channel Adapter held by "Thumb" Screws

Adapter removed exposing the 4-Channel Port Module

4-Channel Port Module being slid from chassis

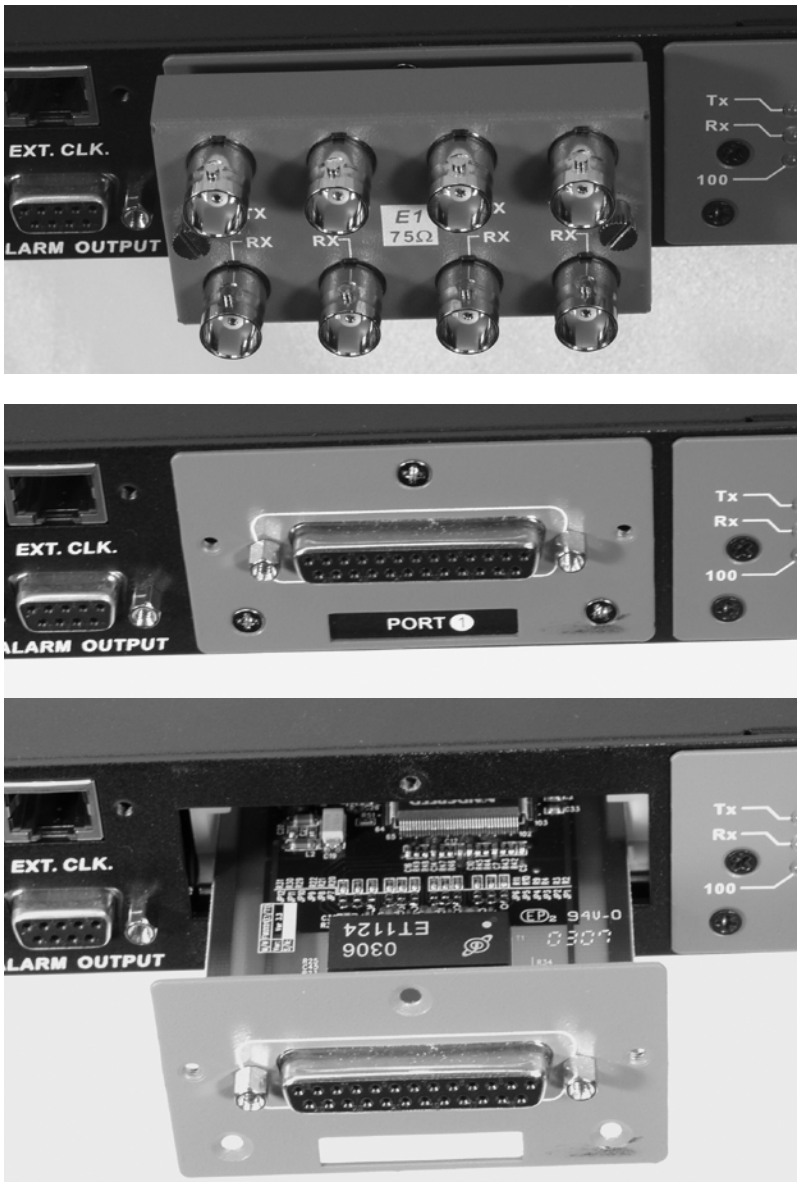


Figure 3-6 : 4-Channel Port Module Removal / Replacement

3.5.3 Top cover Removal / Replacement for internal access

Normally, there is no need to remove the cover of the unit. All interface cards can be removed and replaced without the need to access the internal portion of the ***Fiber Multiplexer***. However, to change any AC or DC power module, add the SNMP and/or External clock feature, or to change the internal firmware, internal access is required and the cover must be removed.

CAUTION

This procedure should only be performed by qualified service personnel. In addition, all power connections must be removed before attempting to open the case.

1. If the unit is installed in a rack, it must be removed.

2. The rack mounting brackets, if installed, must both be removed.

3. Follow the procedure in 3-5-2 and remove the Port No. 2 4-Channel Port module.

4. The top cover is held in place by seven screws. Remove the two upper screws on each side of the unit.

5. From the back of the unit, remove the upper screws on the far left, far right, and center of the unit. (The center screw is hidden unless the No.2 Port module is removed.)

6. Use your finger to push up the top panel through the open Port No.2 hole.

7. Once the back of the top panel is up and cleared, pull it towards the rear of the unit so that the panel slides out from under the lip of the front cover. The internals are now exposed.

Follow the procedure in reverse to re-install the top panel. Install the screws in the reverse order as well, starting with the rear panel center screw, then the left and right rear panel screws and lastly the side panel screws. Re-install the rack mount ears if they were removed.

3.5.4 External Clock Feature Removal / Replacement

CAUTION

This procedure should only be performed by qualified service personnel. In addition, all power connections must be removed before attempting to open the case.

1. If the unit is installed in a rack, it must be removed.

2. Follow the procedure in 3-5-3 to remove the top cover.

3. Remove the two screws on the cover plate for the external clock feature. Once the feature is installed, this cover is no longer needed.

4. Place the ribbon cable on the feature card with the cable going away from the back of the card, noting the polarity of the cable. Place the red stripe to pin #1 on the feature card.

5. Place the RJ-45 connector into the hole cut-out first, align the three holes in the PC board with the three stand-offs. Insert the three pan-head screws that were supplied with the external clock feature kit. Tighten firmly but do not over tighten.

6. Connect the ribbon cable to the mainboard and confirm all pins are properly seated.

7. Re-install the top cover by following the reverse order.

Figure 3-7 : External Clock Rear View

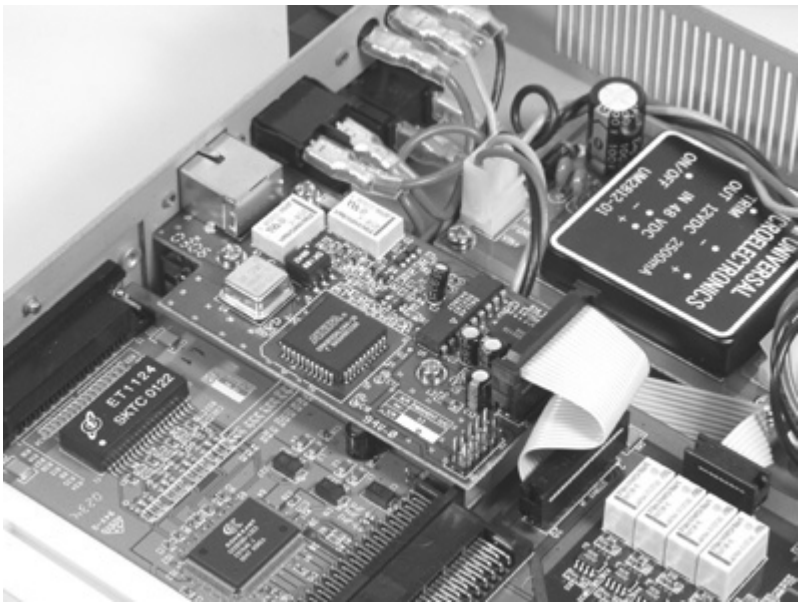


Figure 3-8 : External Clock Option Removal / Replacement

3.5.5 SNMP Feature Removal / Replacement

CAUTION

This procedure should only be performed by qualified service personnel. In addition, all power connections must be removed before attempting to open the case.

1. If the unit is installed in a rack, it must be removed.

2. Follow the procedure in 3-5-3 to remove the top cover.

3. The connector for the SNMP daughter card is just behind the front panel display connector. Carefully seat the card, ensuring no pins are bent. The three holes in the PCB should line up with the three stand-offs on the mainboard.

4. Install the three pan-head screws supplied. Tighten firmly, but do not over tighten. Refer to the photo below.

5. Re-install the top cover.

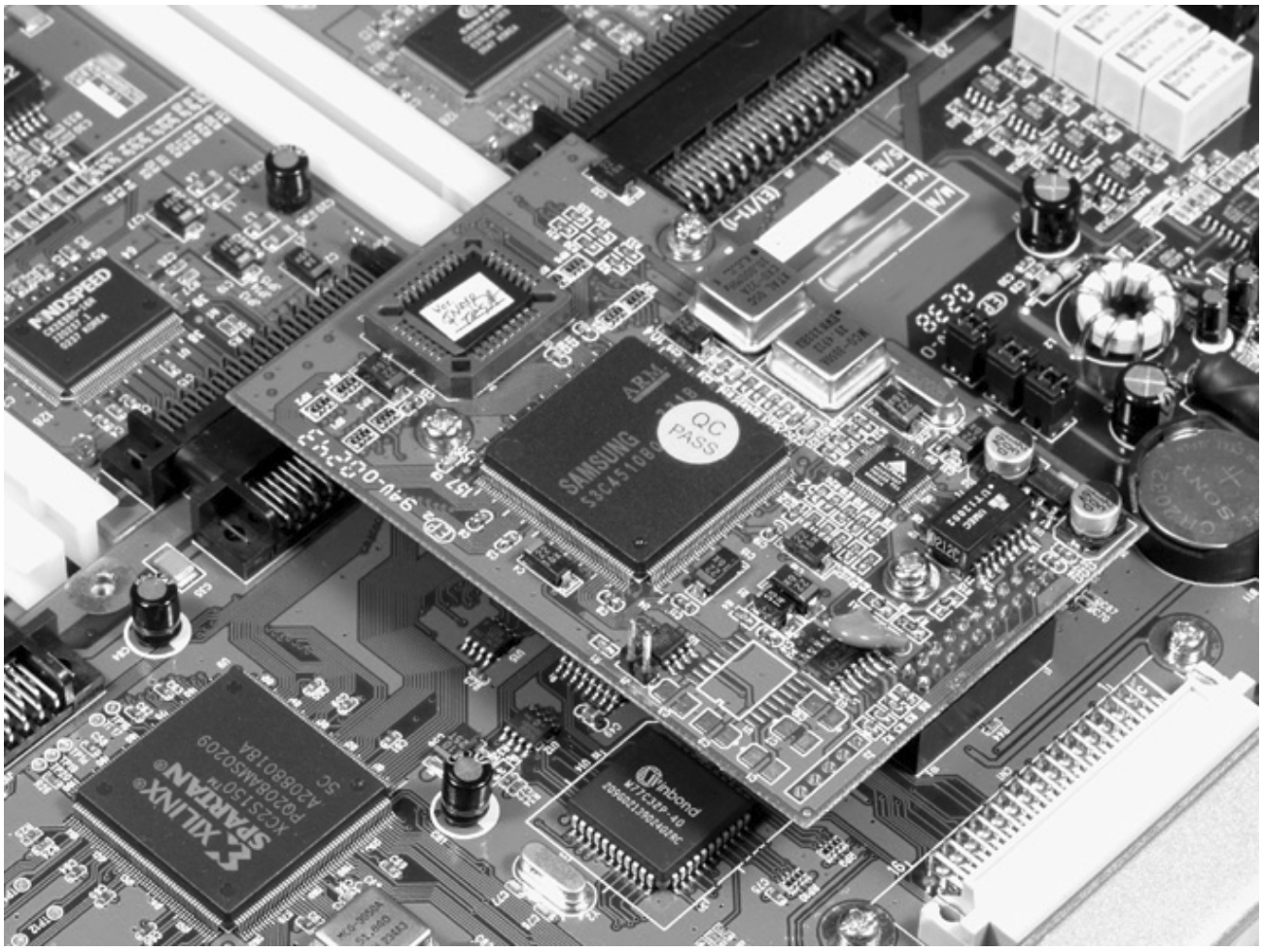


Figure 3-9 : SNMP daughter card Removal / Replacement

Chapter 4. Operation

4.1 Introduction

This chapter will go into the details of the specific configuration and operation of the ***Fiber Multiplexer***. Broken into two parts, the first part outlines the procedures and functions when using the integral LCD display with push-button menu keys. The second section will outline the operation when using a VT-100 terminal connected to the RS-232 Console port. For rapid and more complete operation, a terminal connection to the Console port is recommended.

4.2 LCD Menu Operation

All controls (push-button switches), LCD display and LED indicators are located on the ***Fiber Multiplexer*** front panel. The pushbutton switches are used to activate menu selections and select parameter settings.

Use the '<' and '>' function keys to browse the menus and select parameters.
Use the '**Enter**' function key to enter a sub-menu or to set a selected parameter.
Use the '**ESC**' function key to return to a previous menu or to abandon setup.

When first powered on, the following "Administration" menu will be displayed. If a password has been set, it must be entered to continue. The super user password is "1021" (no quotes). **Pressing ESC from this menu will briefly display the unit's firmware version number.** Pressing either ARROW key at this point will give the option to administer the remote site (as long as there is a valid optical link). Pressing the ENTER key at this point will page the operator at the top of the 10 top level Menus of either the local or selected remote unit. While administering the local unit, the graphic menu arrows will appear as solid black (◂ ▸). While administering the remote unit, the graphic menu arrows will appear as "less than" and "greater than" signs (< >).

```
◂ ADMINISTRATION ▸
  LOCAL  SITE
```

Initial LCD display. Press ENTER to configure the local unit and move to the top level Menus.
Pressing ESC from this menu will briefly display the unit's firmware version number.

```
◂ ADMINISTRATION ▸
  REMOTE  SITE
```

Pressing either Arrow key will provide access to the remote unit.
Press ENTER to configure the remote unit and move to the top level Menus.

4.2.0 Display Version Info From the Administration Local Site Menu or press ENTER to reach the System Config menu.

```
◂   SYSTEM      ▸
    CONFIG
```

Pressing ESC at this menu will display the firmware and FPGA version numbers. (while in local unit only)

```
FPGA  Version  5.1
  FirmwarE  V2.03
```

4.2.1 Top Level Menus The following are the 10 top level Menus. Press the right arrow key to select another top level Menu or press ENTER to reach that menu's sub menu.

```
◄  SYSTEM          ►
   CONFIG
```

Set the Ext Clock (if the option is installed), Save User Set, Load Defaults, Load User Set, Modify Password or Logout. Browse sub-menu items with arrow keys and select with Enter. Browse setting options with arrow keys and set option with Enter.

```
◄  OPTICAL         ►
   CONFIG
```

Set the working modes of Optical 1 and Optical 2 (if installed), the ALS function (Automatic Laser Shutoff), Loopback or BERT function of either optical port. Browse sub-menu items with arrow keys and select with Enter. Browse setting options with arrow keys and set option with Enter.

```
◄  PORT  1-E1  120 ►
   CONFIG
```

Entering this menu allows configuration of the Port Card installed in the Port 1 slot. For the E1 card, the "in service state", Line Code and Loop back functions can be set for each of 4 channels. Browse sub-menu items with arrow keys and select with Enter. Browse setting options with arrow keys and set option with Enter.

```
◄  PORT  2-E1  75  ►
   CONFIG
```

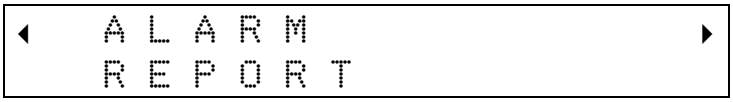
Entering this menu allows configuration of the Port Card installed in the Port 2 slot. For the E1 card, the "in service state", Line Code and Loop back functions can be set for each of 4 channels. Browse sub-menu items with arrow keys and select with Enter. Browse setting options with arrow keys and set option with Enter.

```
◄  PORT  3-T1  100 ►
   CONFIG
```

Entering this menu allows configuration of the Port Card installed in the Port 3 slot. For the T1 card, the "in service state", Line Code and Loop back functions can be set for each of 4 channels. Browse sub-menu items with arrow keys and select with Enter. Browse setting options with arrow keys and set option with Enter.

```
◄  PORT  4-LAN     ►
   CONFIG
```

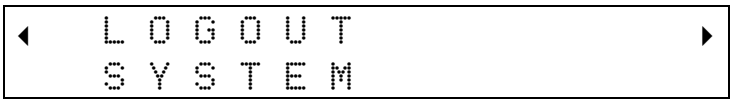
Entering this menu allows configuration of the Port Card installed in the Port 4 slot. "N/A" means that no card is installed in Port 4. Browse sub-menu items with arrow keys and select with Enter. Browse setting options with arrow keys and set option with Enter.



Entering this menu allows "Clearing" the alarm history, setting alarm thresholds, displaying alarm history, and setting function of alarm relays.

Entering this menu allows displaying the current internal performance, the nearest internal performance, resetting the nearest or All performance data.

Entering this menu allows displaying the current date and time, as well as setting or resetting the real time clock's date and time.



Pressing ENTER at this menu will logout of the menu system back to the "Administrator" display and allow re-login or connection to the remote system for further configuration.

4.2.2 Menu Table The following is a breakdown of the menu system for the ***Fiber Multiplexer*** (LCD).

Power on self test		
ADMINISTRATION	[Arrow]	(login to remote)
	[ENTER]	(enter local configuration)
	[ESC]	Firmware version

Local / Remote top menu	Menu Item	Parameter Settings [display]
SYSTEM CONFIG	[ESC]	FPGA/Firmware version
	Ext Clk	OFF
		E1 PCM
		E1 TTL
		T1 PCM
		T1 TTL
		X'TAL
	Save User Set	(saves user defined set)
	Load Default	(restore factory defaults)
	Load User Set	(loads previously saved set)
	Modify PWD	(set administration password)
OPTICAL CONFIG	Opti 1:	work / Off
	Opti 2:	standby / disable
	ALS: (Auto Laser Shutoff)	Auto / Disable
	Loopback:	OFF/LLB/RLB/RRLB
	Status:	Opti 1 / Opti 2
	BERT:	ON / OFF
	Pattern:	SYNC / LOSS
	ErrIns [ENTER]	(insert 1 bit error)
	ErrBit:	(count of single bit errors)
	RxBit:	(count of received bits)
	ErRate:	(bit error rate on fiber)
	Clear [ENTER]	(clears the error bit counter)
Port X-YY, Channel A~D	Service	ON / OFF
	Line Code	HDB3 / B8Z3 / AMI
	Loopback	OFF/LLB/NELLB/RLB/RRLB
ALARM REPORT	Clear History	
	Threshold Set CV:	[255 / 2048 / 65535 bits]
	ES:	[300 sec. / 600 sec. / 900 sec.]
	SES:	[300 sec. / 600 sec. / 900 sec.]
	UAS:	[300 sec. / 600 sec. / 900 sec.]
	Show History	
	Relay	Both/Audible/Visible/All Off
PERFORMANCE DISPLAY	Current Interval CV:	[bits]
	(Port 1-4,Ch.A~D) ES:	[sec.]
	SES:	[sec.]
	UAS:	[sec.]
	Nearest Interval CV:	[bits]
	(Port 1-4,Ch.A~D) ES:	[sec.]
	SES:	[sec.]
	UAS:	[sec.]
	Reset Current	
	Reset All	
DATE & TIME DISPLAY	Date:	[2006/04/17]
	Time:	[13:47:49]
LOGOUT SYSTEM		(return to Administration)

4-1 LCD Menu System

4.3 Terminal Mode Operation

A notebook computer has become an invaluable tool of the Systems Engineer. Connection between the computer and the ***Fiber Multiplexer*** is very straight forward. The only hardware required is a RJ-45 to DB9F adapter cable (see below for pin out). The ***Fiber Multiplexer's*** RS-232 Console port acts as a DCE to the PC's DTE communications port. A convenient application, provided with the Microsoft Windows® 98/NT/2K/XP operating systems, is "HyperTerminal™". The settings for console port communication with the ***Fiber Multiplexer*** are 19.2K baud, 8 bits, no parity, 1 stop bit and no flow control. In the HyperTerminal program terminal window click the "properties" icon and set the communication parameters as in the following graphics. Click the "Configure…" button in the properties window and set the port settings. When set properly, click "OK".

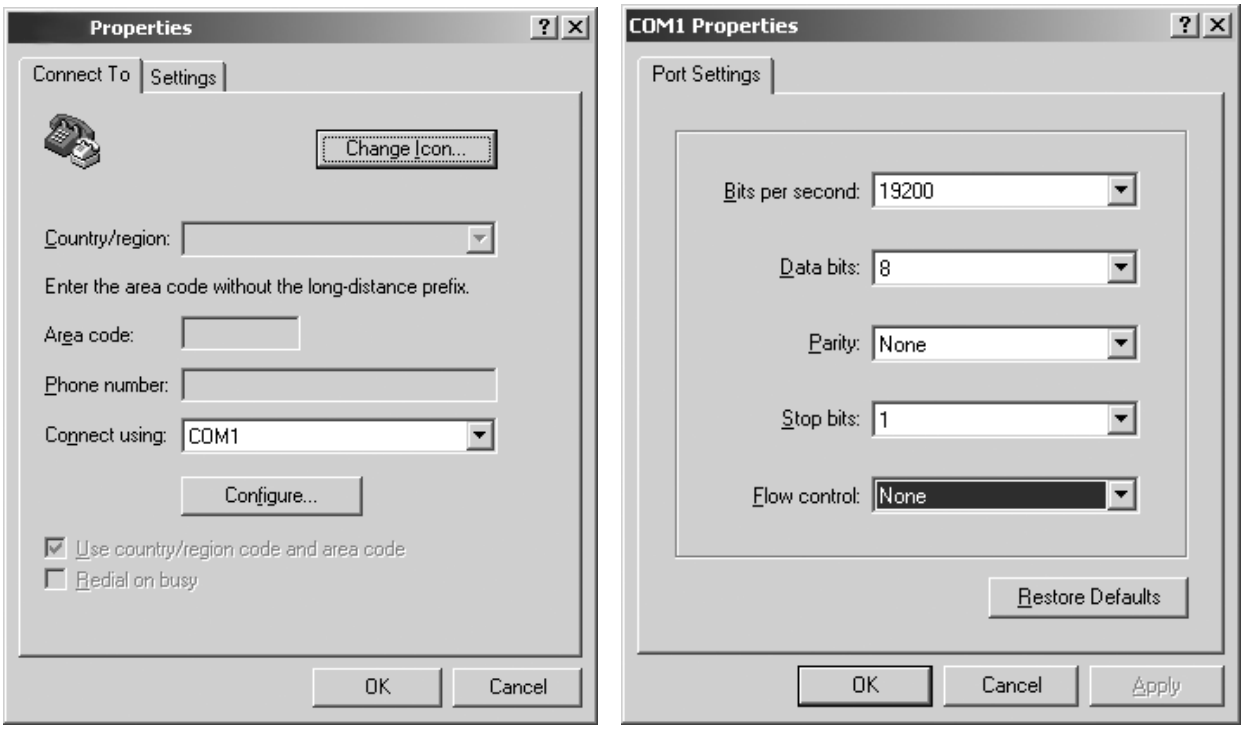


Figure 4-2 HyperTerminal port settings for Fiber Multiplexer

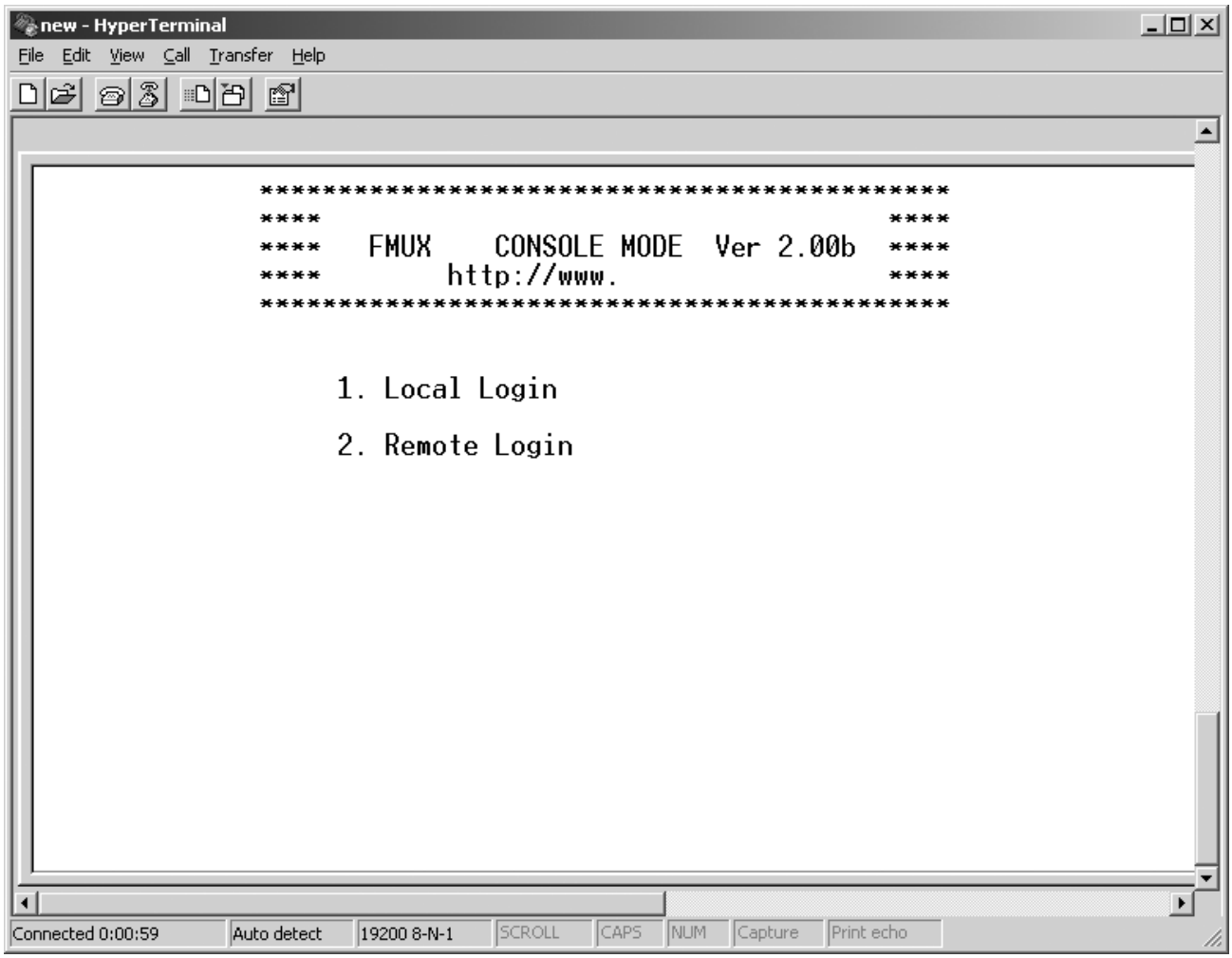
4.4 Connecting to the Fiber Multiplexer

The console port on the ***Fiber Multiplexer*** is an RS-232D interface (DCE) that utilizes an RJ-45 connector. Use the configuration cable that is supplied with the ***Fiber Multiplexer*** or prepare a three wire DB9(F) to RJ-45 cable with the following pin out:

RJ-45	signal	DB9(F)
4	GND	5
5	TD	2
6	RD	3

4.5 Configuring in Console Mode

The ***Fiber Multiplexer*** Control Port (labeled RS-232 CONSOLE on the front panel) is a console terminal port designed to facilitate setup of all parameters through the use of a standard text based terminal or any terminal emulation program running on a Personal Computer. Make the appropriate connections, start the terminal application, apply power to the ***Fiber Multiplexer***, then press ENTER on the PC keyboard. If you are using "HyperTerminal™" the display should similar to the following. (the version may be different)



4-3 Terminal Connection

4.5.1 Local or Remote Login

```
*******************************************
****                                   ****
****          CONSOLE MODE  Ver 2.03   ****
****                                   ****
*******************************************


          1.  Local Login
          2.  Remote Login
```

Press the "1" key to immediately enter into the Local Unit Terminal Mode. The main "LOCAL" root menu will be displayed as follows.

```
LOCAL     *******************************************
          ****                                   ****
          ****          CONSOLE MODE  Ver 2.03   ****
          ****                                   ****
          *******************************************

0.  Logout
1.  Display System Status
2.  Define System Parameter
3.  Alarm Buffer Display
4.  Performance Display
5.  ACO ( Alarm Cut-Off )


Please select the item number.
```

4.5.2 Define System Parameters

Note that the upper left corner will display the word "LOCAL" in inverse text, indicating that the Terminal Mode connection is to the local unit and not the remote unit. If this is our first time connecting and we wish to configure or check the unit's configuration, we can directly enter the "Define System Parameter" menu by pressing "2". The following menu will be displayed.

```
LOCAL              <<< Define System >>>

1.  System Config
2.  Optical Port Config
3.  Port 1 Config.       [ E1 75 ]
4.  Port 2 Config.       [ T1  ]
5.  Port 3 Config.       [ X.21 ]
6.  Port 4 Config.       [ LAN ] [ 100M/F ]
7.  Alarm Threshold
8.  Date & Time
9.  SNMP Card Config


Please select the item or <ESC> to previous menu.
```

Press "1" to enter the System Configuration menu.

```
LOCAL            <<< System Parameter >>>

1.  External Clock      [ OFF ]
2.  Save User Setting
3.  Load Default Setting
4.  Load User Setting
5.  Modify Password
6.  Alarm Relay         [  Both  ]


Please select the item or <ESC> to previous menu.
```

4.5.3 System Configuration

From this menu the item 1, **External Clock**, may be selected OFF, or if option is installed, it may be selected for E1 PCM, E1 TTL, T1 PCM, T1 TTL or to X'TAL (internal crystal) mode. The item 2, **Save User Settings**, all the current settings may be saved for later recall. The item 3, **Load Default Settings**, the factory defaults may be loaded. Be careful, there is no confirmation and the reload is immediate upon entering "3". The item 4, **Load User Setting**, will immediately load a previously saved user setting. The item 5, **Modify Password**, the password to enter administration of this unit may be modified. The password setting must be 4 numerals. When logging in, the password prompt is an empty blank line. Enter the 4 digit password and press Enter. To clear the administration password, modify it by entering four zeros (0000). If you forget the password, the super user password is "1021". The item 6, **Alarm Relay**, the functioning of the Alarm Relays may be set.

The system setting are fairly self explanatory. To configure the Major and Minor Alarm Relays, press item "6". The following menu is displayed.

```
LOCAL            <<< System Parameter >>>


1.  External Clock      [ OFF ]
2.  Save User Setting
3.  Load Default Setting
4.  Load User Setting
5.  Modify Password
6.  Alarm Relay         [  Both  ]
============================================================
    <<< Alarm Relay >>>

1.  Both
2.  Audible
3.  Visible
4.  All Off



Please select the item or <ESC> to previous menu.
```

The Alarm Relays may be set to activate the "audible" alarm relay only, the "visual" alarm relay only, both the "audio" and "visual" relays, or to disable the relays. After selecting the desired action, press the <ESC> key to exit this menu.

4.5.4 System Reset

The "Load Default Setting" option of the System Parameter setting menu, on the previous page, is the method to completely restore the unit to the factory defaults. All channel service status will be "ON", all loop back settings will be "OFF" and all timing modes on data port cards will be reset to "Transparent". In addition, the real time clock will be reset to October 2003.

We will <ESC> back to the Define System configuration and select "2" for Optical Port Configuration.

4.5.5 Optical Configuration

```
LOCAL              <<< Define Optical >>>


1.  Optical 1            [ Work ]
2.  Optical 2            [ Standby ]
3.  ALS                  [ Auto    ]
4.  Loopback             [ OFF   ]


Please select the item or <ESC> to previous menu.
```

The functions in this menu allow configuration of the Optical Card as follows:

Optical 1 set to working mode or Off
Optical 2 set to Standby mode or Disabled
ALS (Auto Laser Shutoff) set to Auto or Disabled
Loopback set to Off or to Local loopback

4.5.6 Port Option Configuration

If we <ESC> back to the "Define System" menu we can configure the card in Port 1 by pressing "3". The following will be displayed. Here is the example for the E1 4-channel module (unbalanced 75 Ohm)

```
LOCAL              <<< Define Port 1 Parameter >>>

                 Ch A       Ch B       Ch C       Ch D

1.  Service      ON          ON         ON         ON

2.  Line Code    HDB3        HDB3       HDB3       HDB3

3.  Loopback     OFF         OFF        OFF        OFF

Please Select Channel A ~ D or <ESC> to previous menu
```

The service status, Line Code setting, and Loopback mode are displayed for each of the 4 channels. To change any of the channel settings, select the individual channel with the corresponding letter A~B~C~D or press <ESC> to exit this menu.

For an example of turning on Loopback for Channel A, press "A". The following menu is displayed.

```
LOCAL                <<< Define Port 1 Parameter >>>

                  Ch A       Ch B       Ch C       Ch D

1.  Service       ON         ON         ON         ON

2.  Line Code     HDB3       HDB3       HDB3       HDB3

3.  Loopback      OFF        OFF        OFF        OFF

 Please select Function 1 ~ 3 or <ESC> to previous menu.
```

Notice that "ch A" is highlighted, indicating it is the selected channel. To modify the Loopback status for the selected channel, press "3"

```
LOCAL                <<< Define Port 1 Parameter >>>

                  Ch A       Ch B       Ch C       Ch D

1.  Service       ON         ON         ON         ON

2.  Line Code     HDB3       HDB3       HDB3       HDB3

3.  Loopback      OFF        OFF        OFF        OFF
============================================================
    [ Loopback ]

1.  OFF
2.  LLB (Local Loopback)
3.  NELLB (Near End Local Loopback)
4.  RLB (Remote Loopback)
5.  RRLB (Request Remote Loopback)

Please select the item or <ESC> to previous menu.
```

Choose the desired loopback mode from the menu shown or press <ESC> to exit.

```
LOCAL                <<< Define Port 1 Parameter >>>

                  Ch A       Ch B       Ch C       Ch D

1.  Service       ON         ON         ON         ON

2.  Line Code     HDB3       HDB3       HDB3       HDB3

3.  Loopback      LLB        OFF        OFF        OFF

Please Select Channel A ~ D or <ESC> to previous menu
```

If we <ESC> back to the "Define System" menu we can configure the card in Port 2 by pressing "4". This is an example for the T1 4-channel module (balanced 100 Ohm)

```
LOCAL              <<< Define Port 2 Parameter >>>

                 Ch A       Ch B       Ch C       Ch D

1.  Service      ON         ON         ON         ON

2.  Line Code    B8ZS       B8ZS       B8ZS       B8ZS

3.  Loopback     OFF        OFF        OFF        OFF

Please Select Channel A ~ D or <ESC> to previous menu
```

The service status, Line Code setting, and Loopback mode are displayed for each of the 4 channels. To change any of the channel settings, select the individual channel with the corresponding letter A~B~C~D or press <ESC> to exit this menu.

For an example of turning service off for Channel D, press "D".

```
LOCAL                <<< Define Port 2 Parameter >>>

                 Ch A       Ch B       Ch C       Ch D

1.  Service      ON         ON         ON         ON

2.  Line Code    B8ZS       B8ZS       B8ZS       B8ZS

3.  Loopback     OFF        OFF        OFF        OFF

 Please select Function 1 ~ 3 or <ESC> to previous menu.
```

Notice that "ch A" is highlighted, indicating it is the selected channel. To modify the service status for the selected channel press "1"

```
LOCAL                <<< Define Port 1 Parameter >>>

                 Ch A       Ch B       Ch C       Ch D

1.  Service      ON         ON         ON         ON

2.  Line Code    B8ZS       B8ZS       B8ZS       B8ZS

3.  Loopback     OFF        OFF        OFF        OFF
============================================================
    [ Service ]

1.  ON
2.  OFF

Please select the item or <ESC> to previous menu.
```

Choose the desired loopback mode from the menu shown or press <ESC> to exit.

If we <ESC> back to the "Define System" menu we can configure the card in Port 3 by pressing "5". The following will be displayed. Here is the example for the X.21 4-channel data communication module.

```
LOCAL              <<< Define Port 3 Parameter >>>

                  Ch A       Ch B       Ch C       Ch D

1.  Service       ON         ON         ON         ON
2.  Rate (Kbps)   2048       2048       2048       2048
3.  Timing        Trans.     Trans.     Trans.     Trans.
4.  Loopback      OFF        OFF        OFF        OFF
5.  CTS           ON         ON         ON         ON
Please Select Channel A ~ D or <ESC> to previous menu
```

The service status, data rate setting, timing mode, Loopback and handshaking mode are displayed for each of the 4 channels. To change any of the channel settings, select the individual channel with the corresponding letter A~B~C~D or press <ESC> to exit this menu. For an example of setting the timing mode for Channel A, press "A". The following menu is displayed.

```
LOCAL                 <<< Define Port 3 Parameter >>>

                  Ch A       Ch B       Ch C       Ch D

1.  Service       ON         ON         ON         ON
2.  Rate (Kbps)   2048       2048       2048       2048
3.  Timing        Trans.     Trans.     Trans.     Trans.
4.  Loopback      OFF        OFF        OFF        OFF
5.  CTS           ON         ON         ON         ON
 Please select Function 1 ~ 5 or <ESC> to previous menu.
```

Note that channel A is highlighted. To modify the timing parameter press "3"

```
LOCAL                 <<< Define Port 3 Parameter >>>

                  Ch A       Ch B       Ch C       Ch D

1.  Service       ON         ON         ON         ON
2.  Rate (Kbps)   2048       2048       2048       2048
3.  Timing        Trans.     Trans.     Trans.     Trans.
4.  Loopback      OFF        OFF        OFF        OFF
5.  CTS           ON         ON         ON         ON
============================================================
    [ Timing ]

1. Transparent
2. Recovery
3. External Clock
4. Internal Oscillator
Press select the item or <ESC> to previous menu.
```

For this example, choose the Internal Oscillator by pressing item "4".

```
LOCAL                <<< Define Port 3 Parameter >>>

                  Ch A       Ch B       Ch C       Ch D

1.  Service       ON         ON         ON         ON
2.  Rate (Kbps)   2048       2048       2048       2048
3.  Timing        Int Osc    Trans.     Trans.     Trans.
4.  Loopback      OFF        OFF        OFF        OFF
5.  CTS           ON         ON         ON         ON
Please select Function 1 ~ 5 or <ESC> to previous menu.
```

Note that the timing setting for channel "A" has changed to internal oscillator. If we <ESC> back to the "Define System" menu we may also configure a card in port 4 by pressing "6". **Please note the following**: The LAN bridge card has no settings which can be performed via the terminal console. Please refer to the bridge card section for setting the DIP switch located physically on the bridge card module.

4.5.7 Alarm Threshold Settings

Next we will escape back to the Define System menu and select item "7" for the Alarm Threshold settings. Press "7" and the display will look like this:

```
LOCAL              <<< Define Alarm Threshold >>>


1.  CV  (Code Violation)          [ 255  ]
2.  ES  (Error Seconds)           [ 300 Sec. ]
3.  SES (Severely Error Seconds)  [ 300 Sec. ]
4.  UAS (Unavailable Seconds)     [ 300 Sec. ]



Please select the item or <ESC> to previous menu.
```

The current threshold settings are shown. The Code Violation, Error Seconds, Severely Error Seconds and Unavailable Seconds thresholds may all be modified here. To modify a setting, choose its item number. The available definitions for all are as follows:

CV: 255, 2048, or 65535 bits
ES: 300 sec., 600 sec., 900 sec.
SES: 300 sec., 600 sec., or 900 sec.
UAS: 300 sec., 600 sec., or 900 sec.

For example to modify the Code Violation threshold, press "1".

```
LOCAL              <<< Define Alarm Threshold >>>

1.  CV  (Code Violation)          [ 255  ]
2.  ES  (Error Seconds)           [ 300 Sec. ]
3.  SES (Severely Error Seconds)  [ 300 Sec. ]
4.  UAS (Unavailable Seconds)     [ 300 Sec. ]
============================================================
    <<< CV Threshold >>>

1.  255 bits
2.  2048 bits
3.  65535 bits

Please select the item or <ESC> to previous menu.
```

Select one of the available settings or press <ESC> to exit.

4.5.8 Setting System Date and Time

If we go back again to the Define System menu, we can next select the Date & Time setting function. Please <ESC> back, then press "8" for item 8.

```
LOCAL                 <<< Date and Time >>>

1.  Date.     [ 2003/10/01 ]

2.  Time.     [ 03:34:15 ]

Please select the item or <ESC> to previous menu.
```

To correct the date and time, press "1" for the date or "2" for the time. The cursor will be placed on the setting for year in Date or for hour in Time.

```
LOCAL                 <<< Date and Time >>>

1.  Date.     [ 2004/03/03 ]

2.  Time.     [ 14:15:15 ]

Press <+>,<-> Key to set, or Press <ESC> to Exit.
```

Use the "+" and "-" keys to the correct Date and Time values, then press ENTER. The cursor will move to the next field, month or minute. Press ENTER after adjusting the parameters. Press <ESC> when finished.

NOTE: When the factory default settings are loaded, the real time clock will require resetting.

(The setting of the SNMP agent is covered under a separate chapter. Please refer to the SNMP operation chapter.)

4.5.9 Display System Status

If we escape back out to the root menu, we can select item #1 to display the system status. The display will look similar to the following.

```
                    <<< FMUX UNIT SYSTEM STATUS >>>        14:27:24

                      PORT 1      PORT 2      PORT 3      PORT 4    Optic  PWR
                   | 1A 1B 1C 1D 2A 2B 2C 2D 3A 3B 3C 3D 4A 4B 4C 4D O1 O2 P1 P2
--- LOCAL --------+------------+-----------+-----------+-----------+-----+------
Service Status     | v  v  v  v | v  v  v v | v  v  v v | v         |W  S |v  v
Loss of Signal     |            |           |           |           |     |
Loopback Status    |            |           |           |           |     |
Major Alarm        |            |           |           |           |     |
Minor Alarm        |            |           |           |           |     |

                   | 1A 1B 1C 1D 2A 2B 2C 2D 3A 3B 3C 3D 4A 4B 4C 4D O1 O2 P1 P2
--- REMOTE -------+------------+-----------+-----------+-----------+-----+------
Service Status     | v  v  v  v | v  v  v v | v  v  v v | v         |W  S |v  v
Loss of Signal     |            |           |           |           |     |
Loopback Status    |            |           |           |           |     |
Major Alarm        |            |           |           |           |     |
Minor Alarm        |            |           |           |           |     |
-------------------+------------+-----------+-----------+-----------+-----+------
                      PORT 1      PORT 2      PORT 3      PORT 4    Optic  PWR
 [v]In Service  [*]LOS  [o]Loopback  [a]minor  [A]major  [S]Standby [W]working

                          Press <ESC> key to Exit.
```

The System Status display gives an overview of the entire system, both local and remote units, the channel conditions, optical connections, and power supply status. In the above display note that all Port cards are installed and that all 4 channels (1A~1B) are in service (v) without any errors from local or remote side except for Port 4 which is a LAN card (The LAN card combines the entire port throughput into a single WAN bridge). The optical 1 (O1) connection is working (W) and optical 2 (O2) is in standby (S) mode. Both power supplies (P1 and P2) are active in both local and remote side units.

The display screen will refresh every 5 seconds. If there is no link to the remote unit, then no status information will be available from the remote side, all fields will go blank, and the refresh will take more than 20 seconds.

Another important diagnostic display of the ***Fiber Multiplexer*** is the Alarm Buffer display. Note that it is item three on the root menu. If we press "3" the Alarm Buffer will display.

4.5.10 Alarm Buffer Display

```
LOCAL                <<< Alarm Buffer Display >>>

    Channel      Alarm Type       ON/OFF       DATE        TIME

  Terminal       Local Login                2003/10/01  11:10:04
  Port 1-Ch A    Loopback          ON       2003/10/01  11:13:45
  Port 1-Ch A    Loopback          OFF      2003/10/01  11:14:08
  Terminal       Local Logout               2003/10/01  11:30:52

                    End of Alarm History

Press <ESC> key to Exit. or Press <C> to Clear Alarm Buffer.
```

The Alarm Buffer can be cleared by pressing the "c" key. Note that each entry in the buffer is "time stamped" with the actual time of occurrence (based on real time clock setting). So it is important to properly set the Date & Time as described previously.

4.5.11 Performance Display

Another important diagnostic display is the Performance Monitor display. This display is also accessible from the root menu, as item "4". The display looks similar to the following.

```
LOCAL                <<< Performance Display >>>


            P1A      P1B      P1C      P1D      P2A      P2B      P2C      P2D
 Line CV:     0        0        0        0        0        0        0        0
 Line ES:     0        0        0        0        0        0        0        0
 Path CV:     0        0        0        0        0        0        0        0
 Path ES:     0        0        0        0        0        0        0        0
 Path SES:    0        0        0        0        0        0        0        0
 Path UAS:    0        0        0        0        0        0        0        0

            P3A      P3B      P3C      P3D      P4A      P4B      P4C      P4D      Opt
 Line CV:     0        0        0        0        0        0        0        0        0
 Line ES:     0        0        0        0        0        0        0        0        0
 Path CV:     0        0        0        0        0        0        0        0        0
 Path ES:     0        0        0        0        0        0        0        0        0
 Path SES:    0        0        0        0        0        0        0        0        0
 Path UAS:    0        0        0        0        0        0        0        0        0

Press <ENTER> to History Interval, or Press <ESC> to Exit.
Press <R> to Reset Current Interval.
```

The performance data for all 16 channels is shown, 4 for each of 4 ports, plus the optical performance. There is a total of 96 history pages, 00~95 with 00 being the current performance display. Each performance history represents a 15 minute interval (900 seconds), while all 96 history intervals represent the last 24 hours. To view a previous performance history interval, press the <ENTER> key and enter the two digit interval ie. enter with the leading zero, 01, 02, 03, etc. There are four (4) intervals per hour, so if we wanted to view the history interval three hours ago, enter interval 12.

To clear all the data in the history intervals, use the "R" key.

4.5.12 Alarm Cut Off

The very last item on the root menu is the Alarm Cut Off function. To turn off an activated audible or visual alarm, the ACU pushbutton on the front of the unit may be pushed or in terminal mode, the alarm may be cut off for the local or remote unit. Press item "5" from the root menu. The "Audible Alarm Cut-off" LED will light on the front panel to indicate ACO.

This completes the overview of the LCD and Console mode configuration and status monitoring of the ***Fiber Multiplexer***.

Chapter 5. Loop Back Testing

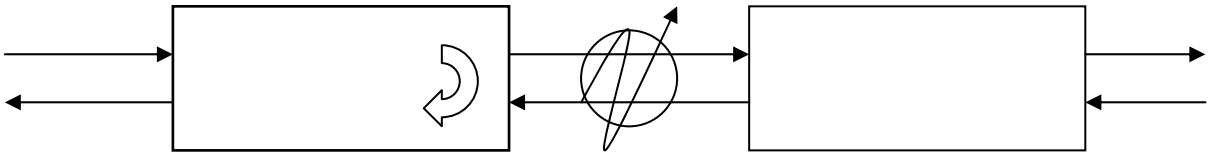
5.1 General

In this chapter we shall explain the functioning of the loop back modes available in the ***Fiber Multiplexer***. The loop back modes available include Local, Remote, and Remote Request Loop Backs for the Optical interface and the secondary Optical interface (if redundant) as well as Local Loop Back, Near End Loop Back, Remote Loop Back, and Request Remote Loop Back for the E1, T1 and Data communication 4-Channel Port Cards.

5.2 Loop Back Modes

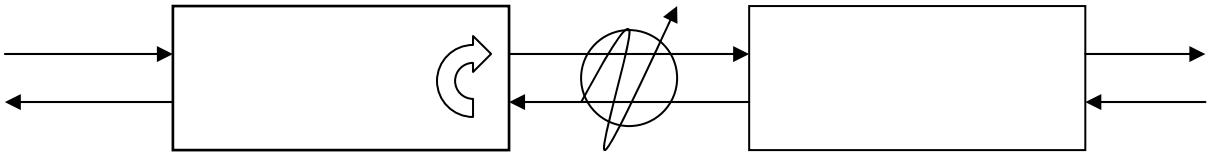
5.2.1 Optical Loop Back

* LLB (Optical local loop back)



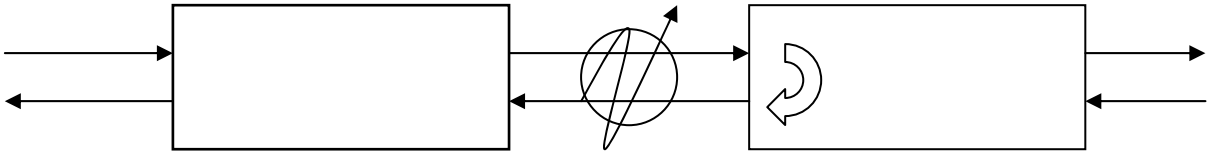
near end (NE) far end (FE)

* RLB (Optical Remote loop back)



near end (NE) far end (FE)

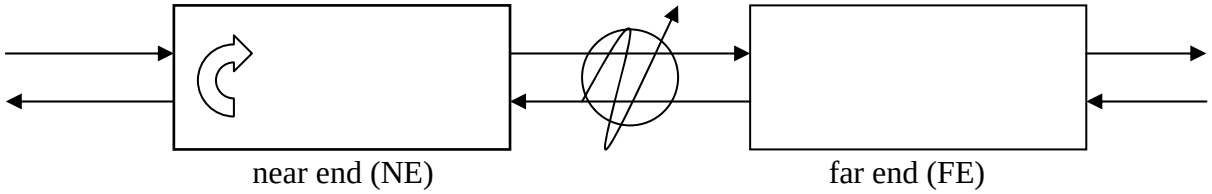
* RRLB (Request optical remote loop back)



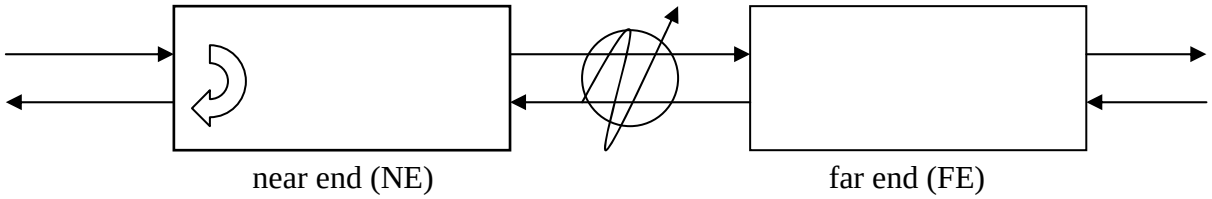
near end (NE) far end (FE)

5.2.2 E1/T1 4-Channel Port Card Loop Back

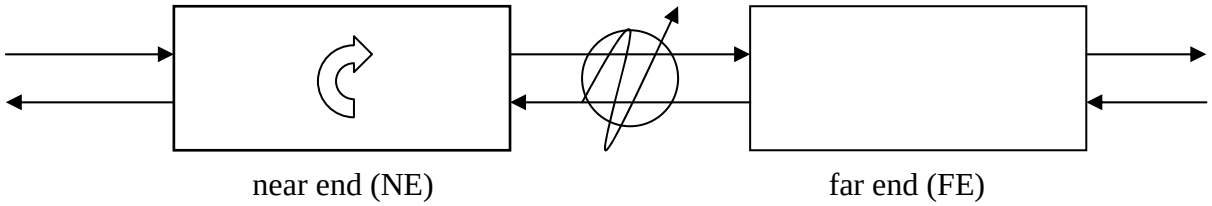
* LLB (T1/E1 local loop back)



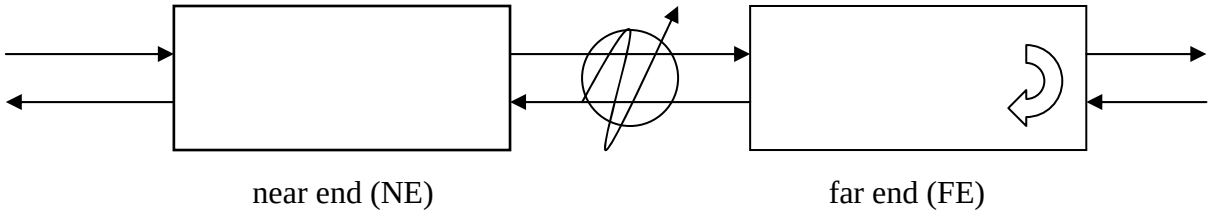
* NELLB (near end local loop back)



* RLB (T1/E1 remote loop back)

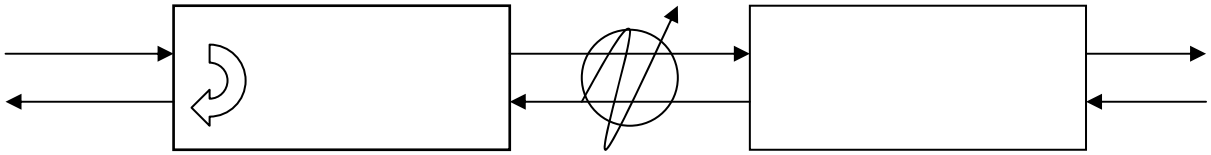


* RRLB (request T1/E1 remote loop back)

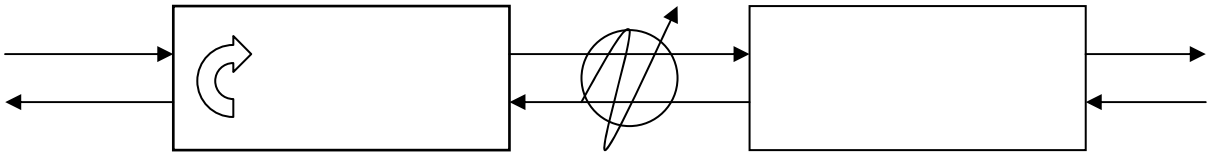


5.2.3 Datacom (RS-530, V.35, X.21, RS-449, RS-232) 4-Channel Port Card Loop Back

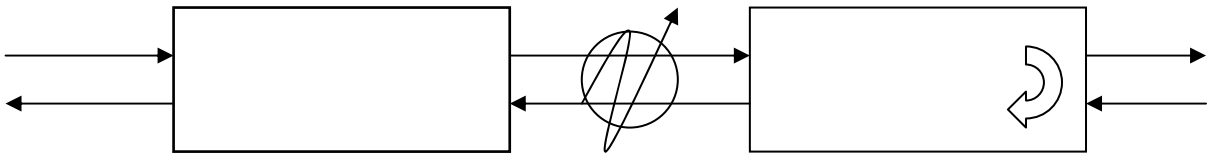
* LLB (local loop back)



* RLB (remote loop back)



* V54up (V.54 remote loop back)

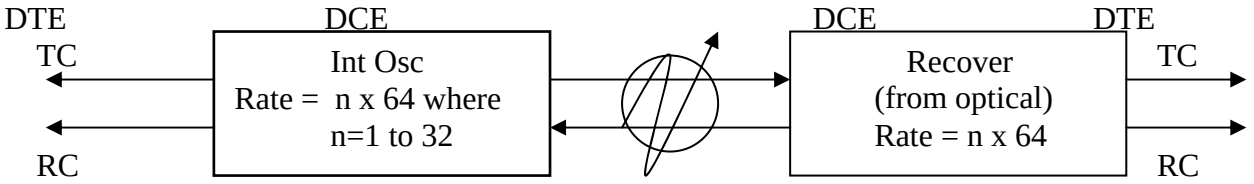


* V54dn will release the remote loop back

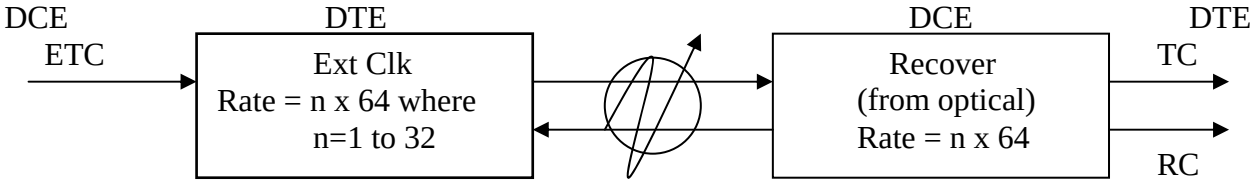
Set the clock "Rate" on all units in any configuration to equal the actual transmission rate. Without proper setting, the loop back functions will not operate properly.

5.2.4 Datacom (RS-530, V.35, X.21, RS-449, RS-232) 4-Channel Port Card Timing

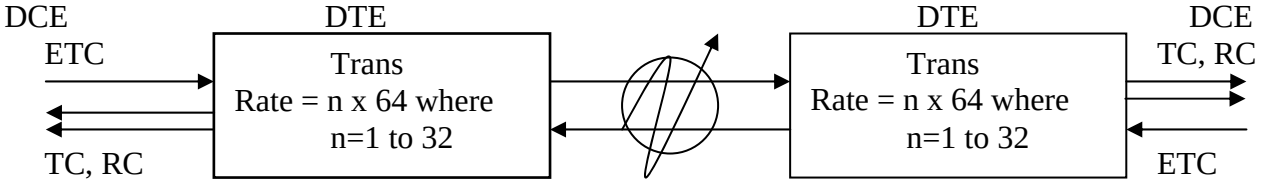
FMUX is DCE and provides clocks to connected DTEs (Internal Timing)



FMUX is placed between existing DCE and DTE (External Timing)



FMUX is placed between two DCE devices (Transparent Timing)



Chapter 6. SNMP Operation

6.1 General

The Simple Network Management Protocol (SNMP) is one of many protocols in the Internet Protocol (IP) suite. SNMP is the protocol recommended specifically for the exchange of management information between hosts residing on IP networks. Network management allows you to monitor and control network devices remotely using conventional computer network technology.

The SNMP management functions of the ***Fiber Multiplexer*** are provided by an internal SNMP agent, which utilizes out-of-band communication over standard 10Base-T or 100Base-TX Ethernet. The SNMP agent is compliant with the SNMPv1 standard. SNMP communications use the User Datagram Protocol (UDP). UDP is a connectionless transport protocol, part of the TCP/IP suite. The SNMP application uses an asynchronous command/response polling protocol and operates at the OSI Layer 7 (Layer 7 is the Application Layer. Other IP applications that operate at this layer are FTP, Telnet, HTTP, SMTP, etc.). All management traffic is initiated by the SNMP-based network management station. Only the addressed managed entity (agent) answers the polling of the management station (except for trap messages).

6.2 SNMP Operations

The SNMP protocol includes four types of operations:

getRequest	Command for retrieving specific value of an "instance" from the managed node. The managed node responds with a **getResponse** message.
getNextRequest	Command for retrieving sequentially specific management information from the managed node. The managed node responds with a **getResponse** message.
setRequest	Command for manipulating the value of an "instance" within the managed node. The managed node responds with a **getResponse** message.
trap	Management message carrying unsolicited information on extraordinary events (that is, events which occurred not in response to a management operation) reported by the managed node.

6.3 The Management Information Base

The management information base (MIB) includes a collection of managed objects. Managed objects are defined as parameters that can be managed, such as specific information on device configuring or on performance statistics values.

The MIB includes the definitions of relevant managed objects (MIB variables) for the specific node. Various MIB's can be defined for various management purposes, types of equipment, etc. The management data itself is a collection of integer, string and MIB address variables that contain all the information necessary to manage the node.

A leaf object's definition includes the range of instances (values) and the "access" rights:

Read-only	Instances of an object can be read, but cannot be set.
Read-write	Instances of an object can be read or set.
Write-only	Instances of an object can be set, but cannot be read.
Not accessible	Instances of an object cannot be read, nor set.

6.4 MIB Structure

The MIB has an inverted tree-like structure (root over leaves), with each definition of a managed instance forming one leaf, located at the end of a branch of that tree. Each "leaf" in the MIB is reached by a unique path, therefore by numbering the branching points, starting with the top, each leaf can be uniquely defined by a sequence of numbers. The formal description of the managed objects and the MIB structure is provided in a special standardized format, called Abstract Syntax Notation 1, or ASN.1 (pronounced A-S-N dot one).

Since the general collection of MIB's can also be organized in a similar structure, under the supervision of the Internet Activities Board (IAB), any parameter included in a MIB that is recognized by the IAB is uniquely defined.

To provide the flexibility necessary in a global structure, MIB's are classified in various classes (branches), one of them being the experimental branch, another being the management (mgmt) branch, and yet another the group of private (enterprise-specific) branch. Under the private enterprise-specific branch of MIB's, each enterprise (manufacturer) can be assigned a number, which is its enterprise number. The assigned number designates the top of an enterprise-specific sub-tree of non-standard MIB's.

Enterprise-specific MIB's are published and distributed by their creators, who are responsible for their contents.

The MIB supported by the ***Fiber Multiplexer*** SNMP Agent follows RFC 1158 (MIB-II standard).

6.5 SNMP Communities

To enable the delimitation of management domains, SNMP uses "communities". Each community is identified by a name, which is an alphanumeric string of up to 255 characters defined by the user. Any SNMP entity (this term includes both managed nodes and management stations) is assigned by its user a community name. In parallel, the user defines for each SNMP entity a list of the communities which are authorized to communicate with it, and the access rights associated with each community (this is the SNMP community name table of the entity).

In general, SNMP agents support two types of access rights:

Read-only	the SNMP agent accepts and processes only SNMP **getRequest** and **getNextRequest** commands from management stations which have a read-only community name.
Read-write	the SNMP agent accepts and processes all the SNMP commands received from a management station with a read-write community name. SNMP agents are usually configured to send traps to management stations having read-write communities.

6.6 Configuring the SNMP Agent

The agent for the ***Fiber Multiplexer*** resides in the SNMP option card installed in the ***Fiber Multiplexer***. Configuration of the agent is accomplished via the RS-232 Control Port of the ***Fiber Multiplexer***. From the Define System Parameter menu select "9", SNMP Agent.

Connect a terminal to console port as usual. Next, login to the local unit.

```
*********************************************
****                                     ****
****          CONSOLE MODE  Ver 2.03     ****
****                                     ****
*********************************************


          1.  Local Login
          2.  Remote Login
```

Press the "1" key to enter into the Local Unit Terminal Mode. The main "LOCAL" root menu will be displayed as follows.

```
LOCAL     *********************************************
          ****                                     ****
          ****          CONSOLE MODE  Ver 2.03     ****
          ****                                     ****
          *********************************************


0.  Logout
1.  Display Multiplexer Status
2.  Define System Parameter
3.  Alarm Buffer Display
4.  Performance Display
5.  ACO ( Alarm Cut-Off )


Please select the item number.
```

Note that the upper left corner will display the word "LOCAL" in inverse text, indicating that the Terminal Mode connection is to the local unit and not the remote unit. If this is our first time connecting and we wish to configure or check the unit's configuration, we can directly enter the "Define System Parameter" menu by pressing "2". The following menu will be displayed.

```
LOCAL             <<< Define System >>>


1.  System Config
2.  Optical Port Config
3.  Port 1 Config.      [ E1 120 ]
4.  Port 2 Config.      [ E1 75  ]
5.  Port 3 Config.      [ T1 100 ]
6.  Port 4 Config.      [ N/A ]
7.  Alarm Threshold
8.  Date & Time
9.  SNMP Card Config


Please select the item or <ESC> to previous menu.
```

Press "9" to enter the SNMP Card Configuration menu.

```
LOCAL              <<< SNMP Card Config >>>


1. SNMP Agent Config
2. Manager Config
3. TFTP and Flash
4. Save and Restart


Please select the item or <ESC> to previous menu.
```

Under item 1, "SNMP Agent Config", the parameters for the local SNMP agent (the internal SNMP card) can be configured. This includes the IP address, subnet mask, and gateway for the card as well as the IP address and server path to the TFTP server for upgrade purposes.

Press "1" to enter the SNMP agent configuration menu.

```
LOCAL              <<< SNMP Agent Config >>>


1. IP Address       [  0.  0.  0.  0]
2. Subnet Mask      [  0.  0.  0.  0]
3. Gateway IP       [  0.  0.  0.  0]
4. TFTP Server IP   [  0.  0.  0.  0]
5. TFTP Server Path    [ ]

Please select the item or <ESC> to previous menu.
```

Item number 1, IP address is the IP address that the SNMP card will answer to when "pinged", Telnet'd, TFTP'd or when accessed by SNMP.
Item number 2, is the subnet mask for the network that the card is attached to.
Item number 3, is the default gateway for the network that the card is attached to and is required if the Fiber Multiplexer is to be managed from a different subnet.
Item number 4, is the IP address of a server running the TFTP protocol (trivial FTP) used for updating the SNMP firmware image in the SNMP card.
Item number 5, is the path and filename of the image file that the SNMP card will download when the TFTP upgrade function is called.

After setting, exit the Agent configuration menu with <ESC> and the save the settings by selecting item "4" from the SNMP Card Config menu or continue to Manager Config.

HINT: *when entering IP addresses, enter without "dots" and include any leading zeros. For example, the above IP address 172.24.1.11 would be entered as 172024001011 while 10.0.0.1 would be entered as 010000000001.*

Remember, when setting the "server path" information for a UNIX or LINUX based server, the upper and lower case must be correctly observed. Also remember that UNIX path separators use "/" while Windows uses "\" to separate path directories.

6.7 Configure the SNMP Manager

From the SNMP Card Config menu, select item "2", Manager Config. Manager configuration is required to tell the agent (the SNMP card) who has authority to access the SNMP via "Get" commands (read) or "Set" commands (write) and where to send "trap" messages (unsolicited messages that are usually generated by alarms in the Fiber Multiplexer).

```
LOCAL              <<< Manager Config >>>


1. Access IP #1           [172. 24.  1.126] [Community #1] [Trap]
2. Access IP #2           [192.168.  0. 15] [Community #2] [Trap]
3. Access IP #3           [192.168.  0.125] [Community #2]
4. Access IP #4           [192.168.  0. 53] [Community #2]
5. Community String #1 (R/W)  [secret]
6. Community String #2 (Read) [public]

Please select the item or <ESC> to previous menu.
```

The manager configuration has the ability to setup access for up to four (4) different management workstations. The community strings act like passwords in dealing with the device via SNMP protocol. By changing the community strings (numbered 1 & 2) for read / write ('secret' in this case) and read only ('public') access, and assigning a community string to an access IP, an administrator can control access to the Fiber Multiplexer.

Note that in the above example, the management workstation with IP address 172.24.1.126 and using the community string 'secret', has full read and write access and receives traps. The management station at 192.168.0.15 has read only privileges when using the community string 'public' and can also receive trap messages. The other two stations at Access IP 3&4 have read only access and do not receive any trap messages. After all settings have been made, <ESC> to the SNMP Card Config menu and do "Save and Restart".

6.8 Save and Restart SNMP

```
<<< SNMP Card Config >>>
1. SNMP Agent Config
2. Manager Config
3. TFTP and Flash
4. Save and Restart
```

When selecting item "4", the card will immediately do a save of the configuration and then reboot the SNMP card.

```
Save to SNMP Card
Wait ……
Restart SNMP Card
```

CAUTION: It is imperative that power not be interrupted while the SNMP card is saving the configuration to flash memory. Failure of power may result in scrambled flash contents and an SNMP card in an un-usable state.

6.9 SNMP Upgrade via TFTP

To upgrade the SNMP firmware, configure a TFTP server on your network. Configuring a TFTP server is beyond the scope of this document. Place the upgrade binary file on the server and set the IP address and path of the server in the SNMP agent. Refer to 6.6 for configuring the SNMP card for TFTP upgrading. From the main SNMP configuration menu, select item #3 to start the upload and upgrade process.

For any changes to be remembered in the agent, please select item #4 to "Save and Reset". DO NOT INTERRUPT POWER DURING SAVE OPERATION OR THE FLASH MEMORY MAY BECOME CORRUPT.

6.10 SNMP Object Details

Object ID	Object ID Description	Values	Note
local_system			
local_System-External-Clock	External clock	clock_Off(0) clock_E1-PCM(1) clock_E1-TTL(2) clock_T1-PCM(3) clock_T1-TTL(4) clock_X-TAL(5) error_Nocard(254)	Cannot be set unless external clock option installed
local_Alarm-Relay	Alarm relay	relay-Both(0) relay-Audible(1) relay-Visible(2) relay-All_Off(3)	
local_Active	Save/load user setting	active-None(0) active-Save_User_Setting(1) active-Load_Default_Setting(2) active-Load_User_Setting(3)	
local_Clear-Alarm	Clear alarm	alarm-None(0) alarm-Clear_Alarm(1)	
local_Status-LED-1	LED Status	[Fail:OF] Failure [Opti(G):ON] Optical green [Opti(R):OF] Optical red [T1(G):ON] T1 green [T1(R):OF] T1 red [E1(G):ON] E1 green [E1(R):OF] E1 red	(Read Only) OF=off ON=on BL=blinking
local_Status-LED-2	LED Status	[ACO:OF] Alarm Cut Off [Opti-1:ON] Optical 1 [Opti-2:ON] Optical 2 [Minor:OF] Minor Alarm [Major:OF] Major Alarm [Far End:OF] Far End Error [Near End:OF] Near End Error	(Read Only)

local_FPGA-Version	System Version	Ver2.03	(Read Only)
local_interface-Card-Type	Local MUX interfaces installed	[Opti:1 + 1] [Port 1:E1 75] [Port 2:T1] [Port 3:X.21] [Port 4:LAN-100M/Full]	(Read Only)
local_Optical-Port			
local_Optical-1	Optical Port on/off	optical-1_Working(0) optical-2_Off(1)	
local_Optical-2	Optical Port on/off	optical-1_Standby(0) optical-2_Off(1)	
local_ALS	Auto laser switch off	als_Auto(0) als_Disable(1)	
local_loopback.0	Optical Port loop back on/off	loopback_Off(0) loopback_LLB(1) loopback_RLB(2) loopback_RRLB(3)	
local_port-1	**(local_p1-E1T1)**	**(local_p1_e1t1_ChA)**	
local_p1cha_e1t1_Service	E1/T1 channel A setting, service	service_On(0) service_Off(1) error_LanCard(252) error_WrongType(253) error_Nocard(254)	same for Ch A-D, E1/T1
local_p1cha_e1t1_Line-Code	E1/T1 channel A setting, line code	line-code_HDB3-B8ZS(0) line-code_AMI(1) error_LanCard(252) error_WrongType(253) error_Nocard(254)	same for Ch A-D, E1/T1
local_p1cha_e1t1_Loopback	E1/T1 channel A setting, loop back	loopback_Off(0) loopback_LLB(1) loopback_NELLB(2) loopback_RLB(3) loopback_RRLB(4) error_LanCard(252) error_WrongType(253) error_Nocard(254)	
local_p1cha_e1t1_LED-status.0	E1/T1 channel A setting, LED status	led_Off(0) led_On(1) led_Blink(2) error_LanCard(252) error_WrongType(253) error_Nocard(254)	(Read Only)
local_port-1	**(local_p1-Data)**	**(local_p1_Data-Comm_ChA)**	
local_p1cha_data-comm-Service	Data channel A setting, service	service_On(0) service_Off(1) error_LanCard(252) error_WrongType(253) error_Nocard(254)	

local_p1cha_data-comm_Data-Rate	Data channel A setting, data rate	data-rate_2048(0) data-rate_64(1) data-rate_128(2) data-rate_192(3) data-rate_256(4) data-rate_320(5) data-rate_384(6) data-rate_448(7) data-rate_512(8) data-rate_576(9) data-rate_640(10) data-rate_704(11) data-rate_768(12) data-rate_832(13) data-rate_896(14) data-rate_960(15) data-rate_1024(16) data-rate_1088(17) data-rate_1152(18) data-rate_1216(19) data-rate_1280(20) data-rate_1344(21) data-rate_1408(22) data-rate_1472(23) data-rate_1536(24) data-rate_1600(25) data-rate_1664(26) data-rate_1728(27) data-rate_1792(28) data-rate_1856(29) data-rate_1920(30) data-rate_1984(31) error_LanCard(252) error_WrongType(253) error_Nocard(254)	
local_p1cha_data-comm_Timing	Data channel A setting, timing	timing_Trans(0) timing_Recovery(1) timing_Ext-CLK(2) timing_Int-OSC(3) error_LanCard(252) error_WrongType(253) error_Nocard(254)	
local_p1cha_data-comm_Loopback	Data channel A setting, loop back	loopback_Off(0) loopback_V54_Down(1) loopback_V54_UP(2) loopback_LLB(3) loopback_RLB(4) error_LanCard(252) error_WrongType(253) error_Nocard(254)	

local_p1cha_data-comm_CTS	Data channel A setting, CTS	cts_On(0) cts_RTS(1) error_LanCard(252) error_WrongType(253) error_Nocard(254)	
local_p1cha_data-comm_LED-Status	Data channel A setting, LED status	led_Off(0) led_On(1) led_Blink(2) error_LanCard(252) error_WrongType(253) error_Nocard(254)	
local_Date_Time			
local_Date	System Date	Change from LCD	(Read Only)
local_Time	System Time	Change from LCD	(Read Only)
local_Performance			
local_performance_Optical	optical performance	Line-[CV: 0] [ES: 0] Path-[CV: 0] [ES: 0] [SES: 0] [UAS: 0]	(Read Only)
local_performance_P1-ChA	channel performance	Line-[CV: 0] [ES: 0] Path-[CV: 0] [ES: 0] [SES: 0] [UAS: 0]	(Read Only)
…continue P1~4, ChA~D			
local_performance_index	history index	[Integer]	(0~95)
local_performance_history_optical	optical history	Line-[CV: 0] [ES: 0] Path-[CV: 0] [ES: 0] [SES: 0] [UAS: 0]	(Read Only)
local_performance_history_P1-ChA	channel history	Line-[CV: 0] [ES: 0] Path-[CV: 0] [ES: 0] [SES: 0] [UAS: 0]	(Read Only)
…continue P1~4, ChA~D			
local_alarm-threshold			
local_CV	CV alarm threshold	cv_255(0) cv_2048(1) cv_65535(2) error_LanCard(252) error_WrongType(253) error_Nocard(254)	

local_alarm-Threshold (continued) local_ES	ES alarm threshold	es_300s(0) es_600s(1) es_900s(2) error_LanCard(252) error_WrongType(253) error_Nocard(254)	
local_SES	SES alarm threshold	ses_300s(0) ses_600s(1) ses_900s(2) error_LanCard(252) error_WrongType(253) error_Nocard(254)	
local_UAS	UAS alarm threshold	uas_300s(0) uas_600s(1) uas_900s(2) error_LanCard(252) error_WrongType(253) error_Nocard(254)	
(end of local branch)			
remote_System			
(identical to local branch)			

6.11 SNMP Trap Messages

Trap messages:

Alarm Buffer Empty
Power Turn On
Power 1 Fail
Power 2 Fail
Alarm Cut-Off
LCD Local Side Login
LCD Local Side Logout
LCD Remote Side Login
LCD Remote Side Logout
Terminal Local Side Login
Terminal Local Side Logout
Terminal Remote Side Login
Terminal Remote Side Logout
Port 1-Ch A Signal Loss ON
Port 1-Ch A Signal Loss OFF
Port 1-Ch B Signal Loss ON
Port 1-Ch B Signal Loss OFF
Port 1-Ch C Signal Loss ON
Port 1-Ch C Signal Loss OFF
Port 1-Ch D Signal Loss ON
Port 1-Ch D Signal Loss OFF
Port 2-Ch A Signal Loss ON
Port 2-Ch A Signal Loss OFF
Port 2-Ch B Signal Loss ON
Port 2-Ch B Signal Loss OFF
Port 2-Ch C Signal Loss ON
Port 2-Ch C Signal Loss OFF
Port 2-Ch D Signal Loss ON
Port 2-Ch D Signal Loss OFF
Port 3-Ch A Signal Loss ON
Port 3-Ch A Signal Loss OFF
Port 3-Ch B Signal Loss ON
Port 3-Ch B Signal Loss OFF
Port 3-Ch C Signal Loss ON
Port 3-Ch C Signal Loss OFF
Port 3-Ch D Signal Loss ON
Port 3-Ch D Signal Loss OFF
Port 4-Ch A Signal Loss ON
Port 4-Ch A Signal Loss OFF
Port 4-Ch B Signal Loss ON
Port 4-Ch B Signal Loss OFF
Port 4-Ch C Signal Loss ON
Port 4-Ch C Signal Loss OFF
Port 4-Ch D Signal Loss ON
Port 4-Ch D Signal Loss OFF
Optical 1 Signal Loss ON
Optical 1 Signal Loss OFF
Optical 2 Signal Loss ON
Optical 2 Signal Loss OFF
Ext Clock Signal Loss ON
Ext Clock Signal Loss OFF
Port 1-Ch A E1/T1 BPV Error
Port 1-Ch B E1/T1 BPV Error
Port 1-Ch C E1/T1 BPV Error
Port 1-Ch D E1/T1 BPV Error
Port 2-Ch A E1/T1 BPV Error
Port 2-Ch B E1/T1 BPV Error
Port 2-Ch C E1/T1 BPV Error
Port 2-Ch D E1/T1 BPV Error
Port 3-Ch A E1/T1 BPV Error
Port 3-Ch B E1/T1 BPV Error
Port 3-Ch C E1/T1 BPV Error
Port 3-Ch D E1/T1 BPV Error
Port 4-Ch A E1/T1 BPV Error
Port 4-Ch B E1/T1 BPV Error
Port 4-Ch C E1/T1 BPV Error
Port 4-Ch D E1/T1 BPV Error
Port 1-Ch A Loopback ON
Port 1-Ch A Loopback OFF
Port 1-Ch B Loopback ON
Port 1-Ch B Loopback OFF
Port 1-Ch C Loopback ON
Port 1-Ch C Loopback OFF
Port 1-Ch D Loopback ON
Port 1-Ch D Loopback OFF
Port 2-Ch A Loopback ON
Port 2-Ch A Loopback OFF
Port 2-Ch B Loopback ON
Port 2-Ch B Loopback OFF
Port 2-Ch C Loopback ON
Port 2-Ch C Loopback OFF
Port 2-Ch D Loopback ON
Port 2-Ch D Loopback OFF
Port 3-Ch A Loopback ON
Port 3-Ch A Loopback OFF
Port 3-Ch B Loopback ON
Port 3-Ch B Loopback OFF
Port 3-Ch C Loopback ON
Port 3-Ch C Loopback OFF
Port 3-Ch D Loopback ON
Port 3-Ch D Loopback OFF
Port 4-Ch A Loopback ON
Port 4-Ch A Loopback OFF
Port 4-Ch B Loopback ON
Port 4-Ch B Loopback OFF
Port 4-Ch C Loopback ON
Port 4-Ch C Loopback OFF
Port 4-Ch D Loopback ON
Port 4-Ch D Loopback OFF
Optical 1 Loopback ON
Optical 1 Loopback OFF
Optical 2 Loopback ON
Optical 2 Loopback OFF
Op1 ALS ON
Op1 ALS OFF
Op2 ALS ON
Op2 ALS OFF
Op2 Worked
System Fail
Op1 Removed
Op2 Removed
Op1 Insert
Op2 Insert
ES exceed
SES exceed
UAS exceed

Technical Inquiry Form

MODEL No.: FMUX01A

Please fill in the configuration settings with '✓' marks into the following table. Send it to us by fax, and we will reply to you immediately.

Firmware Version: _____	FPGA Version: _____
(Press the ESC key from the 'SYSTEM CONFIG' display on the LCD.)	

Installed Options (if any)	External Clock Card	SNMP Card

Optical			ALS:	☐ Auto	☐ Disable
Opti 1:	☐ Work	☐ Off	Opti 2:	☐ Standby	☐ Disable
Type:	☐ 2KM-M	☐ 15KM-S	☐ 30KM-S	☐ 50KM-S	☐ 120KM-S
Connector:	☐ ST	☐ SC	☐ FC	☐ LC	☐ MT-RJ
Loopback:	☐ Off	☐ LLB	☐ RLB	☐ RRLB	

PORT Card 1	☐ G.703 E1	☐ T1 (DS1)	☐ Datacomm	☐ Bridge
Channel A	Channel B	Channel C	Channel D	
Service ☐ ON ☐ OFF	Service ☐ ON ☐ OFF	Service ☐ ON ☐ OFF	Service ☐ ON ☐ OFF	
Line Code	Line Code	Line Code	Line Code	
☐ AMI ☐ HDB3/B8Z3	☐ AMI ☐ HDB3/B8Z3	☐ AMI ☐ HDB3/B8Z3	☐ AMI ☐ HDB3/B8Z3	
Loop Back:	☐ Off	☐ LLB	☐ NELLB	☐ RLB ☐ RRLB

PORT Card 2	☐ G.703 E1	☐ T1 (DS1)	☐ Datacomm	☐ Bridge
Channel A	Channel B	Channel C	Channel D	
Service ☐ ON ☐ OFF	Service ☐ ON ☐ OFF	Service ☐ ON ☐ OFF	Service ☐ ON ☐ OFF	
Line Code	Line Code	Line Code	Line Code	
☐ AMI ☐ HDB3/B8Z3	☐ AMI ☐ HDB3/B8Z3	☐ AMI ☐ HDB3/B8Z3	☐ AMI ☐ HDB3/B8Z3	
Loop Back:	☐ Off	☐ LLB	☐ NELLB	☐ RLB ☐ RRLB

PORT Card 3	☐ G.703 E1	☐ T1 (DS1)	☐ Datacomm	☐ Bridge
Channel A	Channel B	Channel C	Channel D	
Service ☐ ON ☐ OFF	Service ☐ ON ☐ OFF	Service ☐ ON ☐ OFF	Service ☐ ON ☐ OFF	
Line Code	Line Code	Line Code	Line Code	
☐ AMI ☐ HDB3/B8Z3	☐ AMI ☐ HDB3/B8Z3	☐ AMI ☐ HDB3/B8Z3	☐ AMI ☐ HDB3/B8Z3	
Loop Back:	☐ Off	☐ LLB	☐ NELLB	☐ RLB ☐ RRLB

PORT Card 4	☐ G.703 E1	☐ T1 (DS1)	☐ Datacomm	☐ Bridge
Channel A	Channel B	Channel C	Channel D	
Service ☐ ON ☐ OFF	Service ☐ ON ☐ OFF	Service ☐ ON ☐ OFF	Service ☐ ON ☐ OFF	
Line Code	Line Code	Line Code	Line Code	
☐ AMI ☐ HDB3/B8Z3	☐ AMI ☐ HDB3/B8Z3	☐ AMI ☐ HDB3/B8Z3	☐ AMI ☐ HDB3/B8Z3	
Loop Back:	☐ Off	☐ LLB	☐ NELLB	☐ RLB ☐ RRLB

E1/T1 DSU/CSU Series
Fiber Converter Series

CTC Union Technologies Co., Ltd.
Far Eastern Vienna Technology Center
(Neihu Technology Park)
8F, No.60, Zhouzi Street
Neihu, Taipei, Taiwan
Phone:(886) 2.2659.1021 Fax:(886) 2.2799.1355
E-mail: info@ctcu.com http://www.ctcu.com